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AND OF THE

INSTITUTIONS IN UNION.

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111th Session.] FRIDAY, NOVEMBER 18, 1864. [No. 626. Vol. XII.

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Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

Nov. 23.—"On the Application of Iron to the Purposes of War and Naval Construction." By Wm. Fairbairn, Esq., LL.D., F.R.S. On this evening the Duke of Somerset, K.G., will preside.

Nov. 30.—"On the Mechanical Conditions of Railway Working to Prevent Destructive Wear and Risk." By W. Bridges Adams, Esq.

Dec. 7.—"On the Construction, Retardation, Safety, and Police of Railway Trains." By W. Bridges Adams, Esq.

Cantor Lectures.

There will be three Courses of "Cantor" Lectures on the following subjects during the ensuing Session:—

"On the Relation of Science and Art to Manufactures." By B. Waterhouse Hawkins, Esq., F.G.S., F.L.S.

"On the Application of Geology to the Arts and Manufactures." By Professor D. T. Ansted, M.A., F.R.S.

"On the Application of Chemistry to the Arts." By Dr. F. Crace Calvert, F.R.S.

Mr. B. Waterhouse Hawkins will commence his course on Monday evening, the 12th of December.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. Particulars of the Courses will be duly announced in the *Journal.*

Proceedings of the Society.

First Ordinary Meeting.

Wednesday, November 16th, 1864; William Hawes, Esq., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Bickerstaff, William Martin, 13, Highbury-terrace, N.
Bussell, Charles, 26, Soho-square, W.
Clauson, Charles A. R. (Messrs. Rogers, Bros., and Co.), Naples.
Altschul, Dr. D. H., 9, Old Bond-street, W.
Clutton, Robert, Hartswood, Reigate.
Craven, Joseph, Dole Mill, Thornton, near Bradford, Yorks.
Crowther, Wm., Chemical Works, Gomersal, near Leeds.
Darkin, Charles James, 21, Victoria-terrace, Finchley-road, N.W.
Dyer, George, 90, Regent-street, W.
Eskell, Abraham, 8, Grosvenor-street, W.
Evans, John James, Rose-bank, Rock-park, Birkenhead.
Field, John Lyon, Upper Marsh, Lambeth, S.
Ford, Herbert, 8, Pier-road, Erith, S.E.; and 1, Charlotte-row, Mansion-house, E.C.
Frean, G. H., Mill-street, Dockhead, S.E.
Gilbert, Arthur, 12, Claverton-street, Pimlico, S.W.
Green, German, 7, Helmet-row, Saint Luke's, E.C.
Hannah, Robert, 2, Alfred-place West, Brompton, S.W.
Hart, John Matthias, 76, Cheapside, E.C.
Haysman, Jas., F.R.G.S., Burdett House, Burdett-rd., E.
Hollow, Richard Welch (Lord Mayor of York), Mansion-house, York.
Hudswell, W. S., New Railway Foundry, Leeds.
Huggon, William, 30, Park-row, Leeds.
Lainson, Henry, Heath-house, Reigate.
Leycester, George Percival, 6, Oak Hill, Hampstead-road, N.W.
Locket, George, Acton-house, Rosslyn-park, Hampstead, N.W.
Mather, William, Chester-road, Manchester.
Morres, Edward, 43, Parliament-street, S.W.
Nosotti, Charles, 398, Oxford-street, W.
Oertling, Ludwig (Ladd and Oertling), 27, Moorgate-st., E.C.
Oram, John White, 7, Bank-buildings, E.C.
Payne, James Bertrand, 44, Dover-street, W.
Page, Nathaniel, Stag Brewery, Pimlico, S.W.
Pankhurst, R. M., LL.D., South King-street, Manchester.
Robinson, James Edward, Pontefract.
Smith, Joseph, 3, Percy-villas, Wells-st., Hackney, N.E.
Snooke, William, 6, Duke-street, London Bridge, S.E.
Talbot, Robert, Strand-on-Green, Chiswick, W.
Taylor, John, 45, Connaught-terrace, W.
Tucker, Silas, 54, Canonbury-park south, N., and 234, High Holborn, W.C.
Turnbull, Thomas, jun., Whitewell Dockyard, Whitby
Venables, William Vernon, 6, Queen-street-place, E.C., and 20, Canonbury-villas, N.

Wagstaff, John Henry, 9, Sheldon-street, Bishop's-road, Paddington, W.
Walker, W., jun., J.P., Red Hall, Shadwell, near Leeds
Watkins, Major-General, B 3, Albany, W.
Watson, Edward Façon, 201, Piccadilly, W.
Watson, Thomas, 19, Highbury-crescent, N.
Wentworth, J. W. T. Vernon, Wentworth Castle, Barnsley
Whiteside, R. B., 49, Lime-street, E.C.
Whitford, Edward Edmondson, 55, Lansdowne-road, Kensington-park, W.
Willing, James, 366, Gray's-inn-road, W.C., and South Lodge, Ham, S.W.
Wilson, Captain J. H, 35, Pembridge-villas, Bayswater, W.
Wilson, George, Nunthorpe Hall, York.
Wilson, Thomas, 20, Gloucester-square, Hyde-park, W.
Woodthorpe, Edmund, 28a, Basinghall-street, E.C.
Wrentmore, Francis, 250, Regent-street, W.
Yallop, Thomas, 39, Norfolk-square, Hyde-park, W.

And as Honorary Corresponding Members.

Bonghi, Cavaliere Diego, 38, Vico S. Guiseppe de Midi, Naples.
Knight, J. G., Melbourne, Victoria.

The Chairman delivered the following

ADDRESS.

My colleagues having done me the honour to elect me a second time to the office of Chairman of the Council of this Society, it becomes my duty to address you on the opening of the session 1864-65.

The important position the Society now holds among the educational and scientific institutions of this metropolis, the larger and broader views with which we are called upon to consider the various and important subjects to which our attention is necessarily directed, make it year by year more difficult to indicate in the opening address, in conformity with the bye-laws of the Society, the policy which is proposed to be pursued in each session; still this duty is imposed on the Council, and must be discharged; and I trust I shall show that the Council is now, as in previous years, fully alive to its duty.

In accordance with the ordinary custom followed by my predecessors, I must begin this annual address by paying a tribute of respect to the memory of the members of our Society whose loss by death we have to deplore during the past year. The number of members we have lost is unusually large —but as, under the improved management of our *Journal*, an obituary notice—where particulars have been obtained—of each member has appeared soon after his decease, it is unnecessary for me to do more this evening than notice those more especially distinguished in some branch of Arts, Manufactures, and Commerce.

Let me first state that the list of deceased members shows how we draw our members from all ranks and professions. The papers read before us are not, as in most other societies, devoted to one branch of science, and read to those whose attention has been especially directed thereto; but papers relating to almost every branch of Art, Manufactures, and Commerce are either laid before the Council or read at our evening meetings to an audience which is brought together by the interest they take in each specific subject; and from this arises the peculiar freshness, vigour, and interest which distinguish our discussions, and which cannot be so often found at the meetings of any other society; to this must be attributed the fact of our members being derived from all classes of society.

We have lost in Lord Ashburton, who was a Vice-President of this Society, and for some time filled the office of President of the Geographical Society, a great patron of art, science, and literature, who devoted much of his time to the improvement of the moral and social condition of the working classes, and proved his desire to give a practical turn to education, by offering prizes to the scholars of the national schools for their knowledge of common things; and in 1854 he acted as chairman of one of our committees, which recommended that our Society should endeavour to promote the establishment of a normal school for the training of commercial schoolmasters.

In the Duke of Newcastle we have also lost a most distinguished member, whose engagements in public life prevented his taking so active a part as Lord Ashburton in the advancement of practical science, but who never failed to show great interest in whatever promoted the welfare of his country.

In art we have lost Mr. Dyce and Mr. J. D. Harding. Mr. Dyce, R.A., was the son of a physician at Aberdeen, where he was born in 1806, and educated at the Marischal College. He distinguished himself in early life by his attainments; and then, led by a love of art, entered the Schools of the Royal Scottish Academy. At the age of twenty he went to Italy, and spent sometime in the study of the great works of art at Rome and Florence, returning again in a few years to mature his earlier studies. After again passing two years on the Continent he returned to settle in Edinburgh, where he remained about eight years, devoted to historic art, in which he did not find encouragement, but practised chiefly as a portrait painter. Among his varied attainments he had acquired a knowledge of ornamental design; and in 1838 he was induced to accept the superintendence of the School of Design then established by the Government, and in that office and later, as Inspector and Member of the Council of the School, he continued his valuable aid towards its development till 1848, when he finally resigned. In the meanwhile, he had been one of the successful competitors in the Westminster Hall Fresco Exhibition, and in 1845

completed the first fresco on the walls of the new Legislative Palace—"The Baptism of St. Ethelbert." His previous studies, aided by a careful investigation and practice of the art of fresco-painting, had prepared him for the task, and his work was hailed as a success. In 1848 he was commissioned to decorate the Queen's Robing-room, with designs from "The Legend of King Arthur." Of these he only lived to complete five—one large and four smaller subjects, of unequal dimensions. The first typifies Hospitality—The admission of Sir Tristram to the Fellowship of the Round Table. The second, Religion or Faith—The vision of Sir Galahad and his Company. The third, Mercy—Sir Garwaine swearing to be Merciful and never to be against the Ladies. The fourth, Generosity—King Arthur, unhorsed, spared by Sir Launcelot. The fifth, Courtesy—Sir Tristram harping to La Reine Isonde. In these great works, the painter's genius, studied art, and profound learning and judgment have combined to produce a series of decorative paintings, stamped by a feeling of pure art, and admirably adapted by their skilful treatment to the decoration of the Palace. Mr. Dyce had, during his whole career, occasionally exhibited easel pictures; and he will be best remembered by his "King Joash shooting the arrow of deliverance," 1844; and his later works; "The Jacob and Rachel," 1853; "St. John leading home the Virgin," 1860; and "George Herbert, of Bemerton," 1861. His tastes were severe, his drawing and composition scholastic and accurate, and marked by a learned refinement. His colour positive, not graced by the refinements of tint, but well suited to the simplicity of his style. He died, 15th February, 1864, his death, it is to be feared, accelerated by the controversy which ensued on the delay in completing his frescoes in the Queen's Robing-room.

Mr. Harding also deserves notice in this address, although he did not occupy so high a position in Art as Mr. Dyce. He was a member of the old Water Colour Society, and his pictures obtained considerable celebrity, though he was, perhaps, better known to the public as the author of educational works relating to water-colour painting and drawing with the lead pencil, which still retain a high reputation, and are a most valuable contribution to the studies of the young artist and to the practical instruction of the amateur. It is not, I believe, too much to say that some popular art-critics owe a considerable portion of their success to the advantages they derived from constant association with Mr. Harding.

In practical mechanics we have to lament the death of Mr. Thomas Henry Maudslay, of London, and of Mr. Richard Roberts, of Manchester, both distinguished for their great knowledge of mechanical engineering and for the large number of improvements they have introduced in machine tools and in steam and cotton machinery.

In agriculture we have lost Mr. Morton, the elder, and Mr. Beadel, both well known for the active part they took for many years at meetings of agricultural societies, where they always advocated the use of machinery and the most advanced system of farming, as the only means by which the agriculturalist could obtain a proper return for the industry and capital invested.

In literature we have lost Mr. Dilke. The connection of Mr. Dilke with the periodical literature of his time cannot fail to be interesting to our members, and deserves a special record in this address. During his long life he was connected with art, science, and literature, and was elected a member of this Society in 1849. He was almost the first to rely upon the desire of the great mass of the middle class to obtain information connected with art and literature, if it could be provided at a rate which would bring it within their reach; and, carrying this view into practical operation, he reduced, in the year 1831, the price of the *Athenæum* from 8d. to 4d., at the same time enlarging its size and improving the character of its intelligence. At a later period, when connected with the *Daily News*, and before the repeal of the stamp duty on newspapers, in 1846, he reduced the price of this daily journal to 2½d.

In addition to these, I have to notice the death of Sir Wm. Brown, Bart., a distinguished merchant, who, having acquired a large fortune, became a most liberal donor to every institution likely to promote the improvement of the people, and but a year or two before his death built at his own expense and presented to the borough of Liverpool a magnificent library and museum, to be opened free to all the inhabitants of the borough.

In concluding this obituary notice I must not omit expressing the regret of the Council at the sudden loss of one of its younger but very active members, Mr. Frederick Lawrence, whose energy and talent made him a very valuable member of our body.

Before proceeding to the ordinary business of the evening, I must remind you of the very gratifying meeting of this Society which took place in Willis's Rooms, in June last, when His Royal Highness the Prince of Wales, our President, presided over a very large meeting of the Society, and performed, in a most gracious and pleasing manner, the duty of presenting the medals of the Society and other honourable rewards to the persons selected by the Council to receive them. The meeting was of unusual interest, not only on account of its being the first

occasion on which His Royal Highness had presided over a meeting of the Society, but also from the nature and number of the prizes distributed, and the distinguished characters of those who received them. The members are aware that a portion of the subscription raised to record the high sense the Society entertained of the great services rendered to it by its late lamented President, the Prince Consort, was appropriated to the execution of dies for a gold medal, to be given annually to whoever, in the opinion of the Council, had in the greatest degree promoted Arts, Manufactures, and Commerce. The Council, on this occasion of presenting the first medal, through the hands of His Royal Highness the President, selected, I may say by acclamation, Sir Rowland Hill, K.C.B., the originator of the penny postage, as well as of those most complicated arrangements required to carry this new system successfully into practical operation—a merit perhaps greater than that due to him for the original idea—as pre-eminently entitled to receive this testimony of his valuable services. It is not too much to say that Sir Rowland Hill, by this bold conception, has facilitated most materially the commercial transactions of the empire; has greatly promoted the progress of Arts and Manufactures; has given a stimulus to the desire of education amongst the rising generation; and, by facilitating the intercourse between all classes, has materially contributed to improve the social and moral condition of the people. No one will doubt his title to receive from this Society the first Albert Gold Medal. The next prize, the Swiney Prize, consisting of a silver goblet, value one hundred pounds, containing one hundred sovereigns, the proceeds of a legacy left to the Society by Dr. Swiney, to be given, once in every five years, to the "Author of the best published treatise on Jurisprudence," was, on the recommendation of a Committee, consisting of Vice-Chancellor Sir W. P. Wood, Sir Thos. Phillips, and G. W. Hastings, Esq., and others, adjudged to a distinguished civilian, Dr. Maine, a Member of the Supreme Council of India, and late Regius Professor of Civil Law at Cambridge, for his able treatise on "Ancient Law," a treatise which shows not only profound knowledge of the most abstruse principles of law, but the power of treating his subject with a simplicity of style and clearness of expression which render this valuable work interesting even to non-professional readers. Prizes were also given to Mr. Birch for the best design, with working drawings, for improved dwellings for the working classes; to Dr. Van Holst and Sir Wm. Holmes for the discovery and first importation of a sufficient quantity for commercial purposes, of a substitute for gutta percha; to the Artist-Workmen who had successfully competed for the prizes offered for the best specimens of work executed in their own time; and to the successful competitors for the educational prizes and certificates awarded by your examiners.

In my address of last year, when announcing the policy the Council proposed to adopt during the then coming Session, I stated that, in justice to the Council, it was impossible to indicate the policy of any one year without referring to that of preceding years, or without considering the obligations undertaken for future years. I then endeavoured to show how persistently the Society, from its foundation, had promoted the study of the Fine Arts, first among the higher classes; and then, as other institutions were established to carry out a similar purpose, the Society adapted its plans to other classes requiring the stimulus which the publicity of the proceedings of a Society like ours affords. I also showed that we had steadily endeavoured to encourage the education of the industrial classes by the adoption of a system of competitive examination among the members of a large number of Mechanics' and other Educational Institutes in all parts of the country, and that a large measure of success had attended those efforts.

I now propose to show that in the encouragement of Manufactures and Commerce, and in the education of the Art-Workman, we have discharged and hope to continue to discharge an equally important duty. From 1761, when the first Exhibition of New Inventions was held in this house, to the present time, rewards have been constantly offered with a view to promote both Manufactures and Commerce. Commerce the Society promoted by offering prizes for the collection and introduction of new raw materials from all parts of the world. This branch of its duties it has consistently followed to the present time, for prizes, as I have already stated, were given at the last annual meeting for the discovery and introduction to our manufactures of a substitute for Gutta Percha. Time would fail me to enumerate various other vegetable and mineral substances which have been discovered and introduced into this country through the agency of this Society. It is sufficient for my purpose this evening broadly to state the fact, that Arts and Manufactures have been materially benefited by the stimulus the rewards offered by this Society has given to the discovery and importation of a large number of mineral and vegetable products. The Society also, for a great many years after its first establishment, allotted a considerable portion of its funds to the very important object of utilising waste lands by offering rewards, consisting either of the Society's medal or of money, for the purpose of encouraging the planting timber trees of all kinds according to the soils of the respective

districts. The number of trees thus planted, in consequence of the attention directed by the Society to this subject, must be numbered by millions; and no one can doubt the great benefit which has arisen from the value thus conferred upon this otherwise unproductive land. With regard to Manufactures, in the early stages of the Society many useful inventions were submitted to the Council in consequence of the rewards it offered; but the conditions necessarily imposed upon inventors who claimed such rewards that their inventions should become public property, precluded those who believed their inventions to be valuable from applying to the Society for its rewards; but in lieu thereof they appealed to the Patent Office for protection, whereby they hoped to secure the full pecuniary advantage to be derived from their discoveries. Still, notwithstanding this serious obstacle to the Society becoming the great vehicle for the communication of manufacturing improvements to the public, we find, in looking through its Transactions, various suggestions and new ideas, which were ultimately improved and perfected, and led to many important discoveries. But of all the measures the Society has undertaken, none perhaps have been so successful and have so strongly proved its usefulness, as the encouragement it gave, in a very early period of its existence, to the exhibition of works of industry and new inventions. From the date of the first exhibition, in 1761 to 1849, the Society held periodically exhibitions of various kinds, which gradually prepared the way for the favourable reception by the public of the great idea of the International Exhibition held in 1851. From that time to the present exhibitions have been admitted to be most efficient means for conveying to the public a true idea of the progress and state of the Arts, Manufactures, and Commerce of almost every country; and the Council cannot but view with extreme satisfaction the general acceptance of this mode of registering the degrees of industrial progress. A reference to the Index in the last number of our *Journal*, just published, will illustrate my view of the popularity of Exhibitions more thoroughly than any simple statement, for we find that during the past year no less than forty exhibitions have been held in all parts of the world, with a view of exhibiting specimens of Art, of Manufactures, and of natural products. I will not trouble you with reading the names of the places where these exhibitions have been held, as you will find them in the Index of the *Journal* to which I have referred. With regard, therefore, to Manufactures, we must consider the Society rather as a body collecting and publishing new ideas than the absolute originator of great discoveries. But, whilst admitting this, I must claim for the Society the great merit of being nearly the first to direct public attention to the necessity of improving the dwellings of agricultural and manufacturing labourers, and for inviting discussion in these rooms on many of the most important questions calculated to improve their social and mental position. No member of this Society will forget the great interest taken in this subject by our late President, the Prince Consort, who not only was President of the Labourer Friends' Society, but built at his own expense model cottages, as an example to all who interest themselves in the improvement of the social condition of the industrial classes. It is well worthy of remark that as far back as 1779 prizes were offered by this Society for improving the cottages of agricultural labourers; and on a great many occasions, from that time to the present, questions relating to the social condition of particular trades and the effect of strikes, both upon masters and men, have received constant attention by the Society. I allude to these subjects, which are every year increasing in interest, to show how slowly though how certainly all great questions relating to the social condition of the industrial population of this country have advanced in public estimation, till at length the time has arrived when scarcely any one can be found who will justify the present condition or sufficiency of the house accommodation of the great mass of the people.

At the beginning of this year the Society brought out a report on dwellings improvement in the metropolis, which contains, in a condensed and convenient form a large amount of useful data, together with indications of various points on which further information was desirable. Some of this information has since been supplied in the form of communications inserted in the *Journal;* and as regards dwellings reform on the continent, a comprehensive and valuable collection of documents has been received from a Privy Councillor of Bavaria, of which an English abstract is now in preparation.

Towards the close of last session the Society held a Conference to consider the best means of improving the dwellings of the labouring classes, which was well attended, and elicited a great deal of useful and practical information. The main questions brought under discussion were, the cost of new cottages, whether when built they would pay as an investment, and whether if built with proper and decent accommodation, the labourer out of his ordinary wages could afford to pay a rent at all adequate to the cost. As a pure matter of financial investment, it was, I think, shown—and the practical experience of all who have thought on the subject coincides with this view—that no one would be likely to make any serious investment in cottage building; but to landowners and agri-

culturists this is but one part of the question, and perhaps the smallest, for if four or even three per cent. upon the capital invested could be realised, and the labourer thereby provided with decent and healthy accommodation close to his work, there can be no doubt that, besides the return upon the capital embarked in building, received as rent, they would obtain a very large increase in the quantity of work done by each labourer, an increase the value of which it would be difficult to measure in money, but equal to the toil now expended in walking, in all weathers, long distances to and from the place where he is employed, and to the improved health and consequent increased vigour of body which would certainly follow his living in a well-ventilated, well-drained cottage, close to his work. The question of improving the dwellings of the working classes cannot be considered simply as one of cost and wages, for it is quite impossible that improved dwellings to any great extent can be erected by the occupiers of the soil unless they hold their land on such terms that they are certain of obtaining an adequate return for the capital invested. I cannot this evening enter into the numerous questions involved in the consideration of this great subject. I will merely express my hope that the enlarged views with regard to leases, which have been recently expressed by Lord Stanley and others, will ere long so improve the tenure upon which a great proportion of the farms of this country are now held, that every landowner and occupier will find it to be his interest, in a social and pecuniary point of view, to provide proper house accommodation for the labourers on his estate. At the Conference, whilst a great deal of time was devoted to the consideration of the cost for which a new cottage could be built, attention was not I think sufficiently directed to the cheapness with which existing cottages might be enlarged, their drainage and water supply improved, and thus to a great extent rendered both healthy and commodious. I hope that this part of the subject at any future discussion will be fully considered, for it appears to me that by this means great improvements may be made at a comparatively small expenditure, whilst the idea even of the outlay required to build new cottages for the labourers on an estate deters many from giving the subject all the attention it requires. Such was the sympathy excited by the Conference to which I have referred, that the Council resolved to appoint a committee, consisting of gentlemen known to take an interest in this inquiry, and possessing practical knowledge of its details, to consider and report upon the great variety of questions which, in the opinion of the Council, tend to retard the improvement of the dwellings of the working classes. The Council hope that the appointment of this committee will be of considerable service by placing this subject in a practical form before capitalists, landowners, and all interested in the welfare of the community at large, and will assist in removing an evil of great magnitude, the continued existence of which is a disgrace to our country, and most injurious to the welfare of the people; indeed it is hardly possible to understand the apathy that has existed in the minds of the middle and the upper classes upon this subject. It must be so thoroughly the interest of all to cultivate the moral feelings of the industrious classes, that it would appear to be almost one of the first and most essential conditions of employing labourers to provide them with suitable habitations. To preserve their health and that of their families would also appear to be not only the duty, but the interest, of landlords and manufacturers. Men of feeling ought to do this on principle, men without feeling from motives of self-interest. When we recollect that it is from those inhabiting the wretched accommodation in which a large portion of our poor reside that we take our domestic servants, in whom we place so much confidence, and who are so necessary to our comfort, it is difficult to estimate the advantages which would be derived by the public from the improvement in their characters and conduct which would follow their being removed from the over-crowded habitations in which they are now brought up. Indeed I believe there is no more baneful source of intemperance among working men and sickness among their families than is produced by their living in badly-ventilated and ill-drained houses, the atmosphere of which produces that lassitude and debility which they attempt to remove by resorting to spirituous liquors. In every point of view, then, whether of principle or interest, this subject deserves the utmost attention of the community at large. I cannot dismiss this subject without adverting to the present state of the laws affecting the relief and removal of the poor, which it may be hoped will be so far ameliorated as to diminish the objections which now prevail against the providing residences for the poor in the districts where they labour.

In connection with the progress of our manufactures and the prosperity of the working classes, the Society has also given its attention to the question of strikes—a question of almost equal importance to that which we have just considered. Strikes,—the existence of which in the aggravated form lately exhibited in Staffordshire, notwithstanding the great improvement which has taken place in the education of the people,—prove that something is still wanting to afford them individually and collectively a true knowledge of their own interests. This subject will,

I hope, be again brought before the Society during the coming Session. It appears to me that the legislation of the last two years, with regard to commercial and manufacturing companies, opens to working men an entirely new relationship to their employers, which requires much consideration and the special attention of those who direct the education of their children. The large number of industrial establishments hitherto entirely under the control of individuals, but which have recently been formed into Joint Stock Companies, with limited liability, will I hope be the means of gradually preventing the recurrence of those differences between the employers and the employed, which have been prolific in causing mischievous combinations of workmen, and led them to follow the dictum of self-constituted committees, whose object appears to be the attainment of irresponsible authority over their fellow-workmen, rather than the real and permanent welfare of the class to which they pretend to belong. Hitherto the workmen have seen their employers accumulate vast capital, increase and extend their works, and live in almost princely style, upon profits derived in a great degree from their constant toil, and the intelligent exercise of their labour, whilst their own position, from the day they commenced life to their maturer years, has scarcely been improved. They still live in the same ill-ventilated, incommodious, ill-drained houses, in which it is almost impossible for them to maintain their families in health or decency; and perhaps, with the exception of obtaining better education for their children than they could get themselves when children, they are relatively in a worse social condition than their fathers were before them. Such facts, apparent to all, afford to the demagogue ample means and opportunity of exciting feelings of jealousy and distrust between workmen and their employers. Rightly or wrongly they look at the one practical result, that the employers of labour year by year improve their social condition, whilst they see no prospect whatever of any similar advantage being enjoyed by themselves. Under the law of 1862, the great manufacturing and trading companies recently organized must prepare properly authenticated balance-sheets, and thereby enable the workmen to know the exact result of their labour to their employers. Should these results be highly remunerative, and large profits be realized by the union of the capital and intelligence of the master and the skilled labour of the men employed, it will, I think, be difficult for the directors of such companies to avoid considering in what manner they can distribute amongst all connected with such establishments some proportion of the profits obtained. At all events it will afford fair ground and ample knowledge upon which the workmen can press their claims before the directors, who, if they cannot meet them by reason and sound argument, will subject themselves to an amount of disaffection among their men which must ultimately end in the workmen endeavouring to enforce their reasonable requests by declining to work for such employers.

With a view to improve the Art education of working men and to encourage them in the course of self-improvement, the Council last year offered prizes for works of art executed by working men in their leisure time, from drawings and models furnished by the Society. The number of competitors for these prizes was 70, and it was to those who obtained, by the excellency of their work, the rewards offered by the Society, that His Royal Highness the Prince of Wales distributed the prizes at the annual meeting. The success of this attempt to encourage the cultivation of taste and skill was so satisfactory that the Society has published a much more extensive list of prizes, mostly of a higher character than those offered in 1863, to be competed for this year. The Council cannot but believe that the interest they have shown in everything relating to art workmanship has been very instrumental in originating the exhibitions supported by working men themselves which have recently taken place. The first, held in Lambeth, has been followed by one on a much larger scale in the North of London, and each of these exhibitions has in various ways received the support of your Society.

The Council wish, however, to suggest to the great Companies of this City, as well as of the municipal bodies in the country, the great benefits which must follow their occasionally combining to exhibit to the working classes the precious specimens of High Art Workmanship which many of them possess. To a workman, the knowledge that a particular work of Art can be produced, especially if he can see and examine it, is sufficient to stimulate him to attempt a work of Art of equal merit, and perhaps to excel it.

The Executive Committee of the Dublin International Exhibition, to be held next year, have formed a Committee of Advice, consisting of members of this Society and others, which is to meet in London, and the Council have given their consent to the meetings of the Committee being held in this house, hoping thereby to contribute to the success of the exhibition. At the same time, the Council have expressly stated to the Executive Committee that this Society would not incur any pecuniary responsibility in connection with such Exhibition.

Since we last met it is generally understood that the Royal Commission appointed to con-

sider the operation of the Patent Laws has made its report, but their report, although copies have been obtained by a few individuals, has not yet been issued to the public. I do not think it necessary, under these circumstances, to refer to the subject further, as no doubt, during the coming Session, when the report is published, it will be brought under the consideration of the Society at one of our weekly meetings.

The success of the Cantor Lectures last year has encouraged the Council to provide another series of three courses of lectures, to be delivered by Dr. F. C. Calvert, "On the Application of Chemistry to the Arts;" by Mr. Waterhouse Hawkins; "On the Relation of Science and Art to Manufactures;" and by Professor Ansted, "On the Application of Geology to Arts and Manufactures." Last year, uncertain of what the attendance might be, the Council issued tickets for the admission of two friends by each member; but owing to the number of members who were precluded, by the crowded state of the room, from attending these lectures, the Council, this season, must limit the issue of tickets to one for each member. Programmes of these lectures, and the days on which they will be delivered, will be duly announced in the *Journal.*

Having thus traced the progress of this Society almost since its first establishment, in its endeavours to promote improvements in our Manufactures and the extension of our Commerce, I will now endeavour, in conformity with the bye-law, to place before you the policy the Council intend to pursue during the coming Session. Continuing the measures we have taken to promote the education of Art-Workmen, we hope by extending the sphere of our operations and offering a greater encouragement to compete for the prizes the Society will offer, to produce greater results than have hitherto been attained in that direction. By the continuance of the Cantor Lectures we hope to afford to our members and their friends the means of obtaining the best and latest information on the subjects to which they relate.

The Wednesday evening Meetings will be continued as usual, and the Council hope that the members of the Society will assist them in making them as interesting as possible, by communicating the results of any new discoveries or processes, in papers, to be read at these meetings; and they are glad to announce that the season will be opened by a paper on the "Application of Iron to the purposes of War and Naval Construction," by Wm. Fairbairn, Esq., LL.D., F.R.S.

It will interest the members to hear that Mr. F. A. Paget, who read a paper in May last on "The Testing of Chain Cables," has, in consequence of the knowledge he displayed in that paper, been requested, by the Board of Trade, in conjunction with Sir Wm. Armstrong, Mr. Wm. Fairbairn, Mr John Hicks, Mr. J. Nasmyth, and Mr. J. Penn, to report on the rules and regulations to be adopted by the Government in reference to the manner in which the testing operations, as directed by Mr. Laird's Act last session, shall be conducted.

Through the inquiries of the Committee appointed to consider how the difficulties which now appear to retard the provision of proper dwellings for the working classes may be overcome, we trust we shall be able to suggest measures by which this great plague-spot in the social condition of the mass of the people of this country may be materially mitigated if not removed. No subject can be more worthy the attention of the Society.

And continuing to investigate the causes of strikes, in connection with the altered state of the law of partnership, the Council hope still further to promote the harmonious working of that vast power which is wielded by the industrious classes of the kingdom, and which, if directed by sound principles, must tend very much to promote the prosperity of the manufacturers of this country.

It is specially a duty of this Society to persevere in this inquiry, now that some persons are doubtful as to the beneficial results of education amongst the working classes, attributing to it the greater power of mischievous combination, instead of considering in what respect the present education is imperfect, and the means whereby it may be more strictly adapted to the wants and special necessities of the industrial classes.

It is not customary I believe in these addresses to allude to public works, but those now in progress are of so much importance, and calculated in so high a degree to promote the objects the Society has in view, that I cannot avoid referring to them. The system of main-drainage, being carried out under the superintendence and according to the plans of Mr. Bazalgette, is a work worthy of the greatest city in the world, and no one can doubt that it will materially improve the sanitary condition of this metropolis; but, perfect as this system appears to be, it will be deficient in one great element of success if the refuse matter conveyed through its channels be not turned to some useful and profitable account. I hope we may have papers read at our evening meetings on this interesting and important subject, for it is one which ought to engage the attention of the mechanical engineer, the practical manufacturing chemist, and the agriculturist. And alluding to the drainage of London leads me to say a few words on the drainage and water supply of country towns and rural districst.

In a sanitary point of view this is of equal importance to the drainage of London; for, although there are not the same number of people crowded on a given surface, the want of proper drainage contaminates the water usually drawn from shallow wells, and produces most serious effects upon the health of the people.

The second public work to which I will refer, the Thames embankment, though of a totally different character, will produce results of almost equal utility and advantage, but this work differs in one respect from the main-drainage works, inasmuch as it will afford opportunities for the introduction of taste and ornament in its design, and will form one of the greatest attractions of this metropolis. The Thames embankment must be considered as the first great public work undertaken with a view as well to the embellishment, as for the improvement in the communication between distant parts, of this great city. It is rare, indeed, that it devolves upon one man to execute two such works, and to distinguish himself by the skill with which he has overcome the difficulties incidental to carrying out the system of drainage of a large city, and to exhibit so much taste and constructive skill as he has displayed in his designs for the embankment. Both of these works deserve the special notice of our Society during their progress toward completion, and I hope we shall find members willing to bring them before us, and to do justice to their respective merits.

Our underground railways, although conducted by public companies for individual advantage, may, from their great extent and importance, be considered as public works. I am more particularly induced to notice them, as they appear to be defective in one or two respects, which will offer good subjects for papers to be read at our meetings. The motive-power now used, and the ventilation required to remove the products of combustion incidental to the use of this motive-power, afford a fine field for the display of the ingenuity of the mechanical engineer. Perhaps it may be bold to recommend the introduction of the atmospheric system, which is associated in the public mind with most expensive failures, though on consideration it will perhaps be found that the causes which produced these failures do not exist in an underground railway. It was generally understood to be impossible to make a luting which would be equally effective in maintaining the partial vacuum required in the hottest day of summer and the coldest day in winter, involving as it does a variation of 60^0 to 80^0 of temperature often within a few hours; but in the underground railways, the temperature in summer and winter varies but little—certainly not sufficiently to destroy the efficiency of a carefully-prepared luting. We hope that this subject will meet with the attention it deserves, for if found to be practicable, it would materially add to the comfort of travellers by this novel, and, in many respects, most advantageous mode of conveyance.

In concluding this address I must express the gratification of the Council, which will, I am sure, be shared by the members present, at the very eulogistic manner in which the exertions of the Society, in promoting education among the members of Mechanics' Institutes and other kindred bodies, by means of competitive Examinations, have been noticed by distinguished members of Parliament and others, when speaking during the last few months upon the various modes by which a good education can now be obtained by almost every class of society. There appears every reason to believe that the Certificates granted by our Examiners are highly valued, and assist those who attain them in their advancement in life. We have also every reason to be satisfied with the annual increase in the number of papers submitted to the Examiners, and with the steady improvement in the degree of information exhibited in the papers prepared by the competitors for prizes.

I hope it may not here be out of place to refer to the want of public recognition which exists in this country for the highest class of intelligence, when devoted to the improvement of the Arts and the extension of our Manufactures and Commerce. Recently, no doubt, the Government has conferred honours on a few distinguished merchants and manufacturers, but such honours, having had in almost every case something of a political character, have been deprived of their value as a public testimony to services rendered through a long series of years in aiding to build up that great fabric of Commerce and Manufactures of which we are so justly proud, and upon the maintenance of which, in all parts of the world and among all nations, our national power and influence so much depends.

I am happy to congratulate the members on the continued prosperity of the Society, our numbers being larger than at the opening of any previous session; and the interest taken in the papers read at our evening meetings, shown by the numbers regularly attending them, proves that the policy hitherto pursued by your Council has been approved by the Society.

I trust that the statements I have been able to make this evening justify a confident anticipation of an equally successful progress during the session I have now the satisfaction to open.

After the delivery of this Address,

Vice-Chancellor Sir W. PAGE WOOD said he desired to submit to the meeting a resolution, which he was confident

would be received with acclamation, viz., a vote of thanks to the chairman for the very admirable address he had delivered. They had been accustomed to hear very able addresses from that chair. He would not make comparisons, but he would venture to say they had heard none more able than that with which they had been favoured that evening; and especially gratifying must the last announcement be, that the number of members of the Society was larger than at the opening of any former session; and when they looked back on the various subjects which had occupied the attention of the Society, as detailed in the address, the cause of this continued increase in the members was apparent. The Society had taken a great start from the period when it had adopted broader views in the promotion of Arts, Manufactures, and Commerce. The Society's rewards were bestowed with great care, and awarded to those who had done great services in promoting industrial progress and the welfare of mankind. When they saw that men of such eminence as Sir Rowland Hill and Dr. Maine felt themselves honoured in receiving the prizes of this Society, it was an evidence that it had risen in estimation, and was fully carrying out the important objects for which it was instituted. He considered this Society filled, with respect to Arts, Manufactures, and Commerce, the position which was occupied in commerce by the broker or agent. The broker ascertained and supplied the wants and needs of different classes of the community, and in like manner this Society received and diffused information for the benefit of those engaged in the several branches of science and industry to which its attention was directed. Such had always been the function of the Society, and it had of late years greatly increased its usefulness by adopting two special modes, which, though apparently different, were in reality based upon the same principle, the one stimulating the talent and skill of the younger branches of the community, and the other that of those more advanced in life and position. The examinations established by the Society accomplished the one; and on the other hand exhibitions might be regarded as competitive examinations for those engaged in industrial pursuits, in which men produced the best examples of their skill and placed them in competition with the whole manufactures of the world. Such was, he apprehended, the position which this Society was now taking; and how large were the sympathies of the Society in this matter had been admirably shown by the varied characters and position of the members whose deaths had been noticed by the chairman. They found mention of one man distinguished in the fine arts as a painter; they had lost another member noted in the walks of literature; and others in the mechanical art. The whole list of the Society, indeed, showed how men, distinguished in various walks of life, each devoted to his own pursuit, yet worked together, exercising the powers with which they had been gifted by their Maker for promoting the social happiness, the social comfort, and the social advancement of their fellow-men. He trusted that the very able remarks of the chairman with reference to the dwellings of the working classes would not be lost upon any present. This was a subject worthy of the utmost consideration in connection with a class of the community to whom they were so much indebted—men upon whose labour, and industry, integrity, sobriety, and morality, depended the whole constitution and fabric of the state; for he did not hesitate to say, if they had a corrupted working class, there could never be a great country or a great nation. It was a source of satisfaction to know that they had a working class which he might say, with some knowledge of the workmen of other countries, stood in a high and distinguished position with reference not only to industry—for that was known to the whole world—but in morality and integrity. Where there were defects, they might be traced to the miserable condition of the habitations in which so many were compelled to live. The railways, whilst they had driven vast multitudes of the working classes from their former habitations, promised to do much in the way of remedying this evil. They had heard on former occasions of plans devised, not only from motives of benevolence, but upon the soundest principles of political economy, for conveying the working classes at cheap rates, not only from one part of the metropolis to another, but to localities where suitable habitations were provided at rents within their means. The chairman that evening had made reference to other plans, into the details of which it was not his province to enter. The chairman had stated, to his (Sir W. P. Wood's) surprise, that some copies of the Report of the Commission appointed to consider the working of the Patent Laws had got abroad. Now, as he happened to be one of the commissioners, and as he had not yet signed the report, he was at a loss to understand how any copies of it had got abroad. It was no doubt a subject of great importance to all interested in it, but he might say, as had already been stated by the chairman of that commission (Lord Stanley), that he was afraid it might much disappoint those who expected great results from it. He drew attention to the several topics in the Address, because he felt that, to the wide range of subjects which occupied their attention, was mainly due its increasing numbers and its means of usefulness; and while the Society continued to be guided by the principles on which it had been governed for several years past, and for the introduction of which, it must be recollected, they were largely indebted to the personal interest of the late Prince Consort, future chairmen would report its continued prosperity. He begged, in conclusion, to ask the members of the Society to tender to the chairman their best thanks for the able address he had given them.

Mr. John Dillon seconded the motion.

Mr. Hartley, as a manufacturer and large employer of labour, called attention to the great scarcity of skilled labour in this country, which he said was the case to such an extent that a very large amount of skilled workmanship had to be sent abroad to be executed. This was a subject which he hoped would be taken up by the Society. There were abundant means of supplying the requisite amount of skilled labour which an increasing trade demanded; and the advantage to a boy being properly educated as a skilled workman was equal to giving him £600.

Mr. P. Palmer expressed a hope that the influence of the Society and of the Chairman, as a member of one of the principal City companies, would be exerted to induce those corporations to exhibit the rich treasures of works of art which they possessed for the benefit of the community. He thought it would well comport with the position and dignity of the great City companies to co-operate with the Society in the way he suggested in aiding the spread of the art education of the country.

Mr. Harry Chester might so far answer, on behalf of the Council, the observations just made by stating that the question of skilled labour was one which had largely engaged the attention of that body. They were aware of the great want that existed. They were not, however, at present prepared with any particular plan from which they hoped to derive any great results in that direction; but it was a subject which in various forms had been always more or less before them. The exhibitions which had been suggested by the last speaker might have a tendency in that direction, and it would be most gratifying to the Council to give their aid to any scheme which promised to be instrumental in carrying out the extension of their object.

The resolution having been put was carried by acclamation.

The Chairman acknowledged the high compliment which had been paid him.

The Secretary called attention to some very fine

photographic enlargements from small negatives, executed by means of Dr. Van Monkhoven's improved solar camera, and lent by Mr. J. H. Dalmeyer.

Proceedings of Institutions.

Farnham Young Men's Association.—On Friday evening, November 4th, the lecture session of 1864-5 was opened with the delivery of a lecture, by the Rev. J. McConnel Hussey, of Brixton, on "Home." The Bishop of Winchester, president of the association, occupied the chair, and in introducing the lecturer congratulated the members on the advancing prosperity of the association, and gave particulars in reference to the past lecture session, the working of the library, and reading room.

London Mechanics' Institution.—On Friday evening, the 4th of November, a distribution of the prizes and certificates obtained by the members of the Institution at the last Examination of the Society of Arts; also at the Examination of the Metropolitan Association for Promoting the Education of Adults; and also the prizes offered to the classes by the Local Board of the Institution, took place at the London Mechanics' Institution, Southampton-buildings, Chancery-lane. The prizes consisted of standard popular works, in handsome bindings. Mr. Harry Chester presided, and the Honorary Secretary of the Local Board of Examiners stated that the candidates examined this year, while obtaining a fair share of honour for themselves, had not failed to maintain the reputation of the Institution. Eighteen candidates presented themselves to the Board for the Preliminary Examination required by the Society of Arts, of whom sixteen were passed for the Final Examination by the Society's own Examiners. Of these, fourteen attended, and obtained between them (none having been rejected) twenty-seven certificates—nine first-class, fifteen second, and three third—with the first and second prizes in logic, the second prize in English history, and the third in English literature. A number of the junior and less advanced members of the Institution had availed themselves of the Examinations of the Metropolitan AssocAiation for Promoting the Education of Adults, which, like those of the Society of Arts, were conducted by the Local Board, but were of a more elementary character. The candidates obtained a fair proportion of certificates, and several of the principal prizes offered by the Association. A Competitive Examination of the classes of the Institution had been held by the Local Board, and book prizes awarded to the successful candidates. Mr. Reed appealed to the members for donations to the prize fund, in the shape of books or money, and as an instance of the successful working of the Board, stated that during the past five years only one candidate passed by them for the Examination of the Society of Arts had been rejected. The Chairman, with a brief explanation of the nature and working of the Examinations, proceeded to distribute the certificates and prizes, at the same time announcing that Her Royal Highness the Princess of Wales had given a prize of a Bible, value three guineas, to be contended for in needlework by young women. Her Royal Highness's name would be written by her own hand in the Bible. The prizes having been distributed, the chairman, in closing the proceedings, congratulated the meeting on the great success of this, the oldest of the Mechanics' Institutes. The City of London College, which was a much larger Institution, sent up a greater number of candidates, but for its size none had been more successful than the London Mechanics' Institution, nor had entered more heartily into the views of the Society of Arts. They had opened three classes to women, which he thought a great advantage. He did not approve of opening the Universities to females, but hoped that before long a suitable scheme would be matured for the furtherance of female education. The proceedings terminated with a cordial vote of thanks to the chairman.

Marlborough Reading and Mutual Improvement Society.—The twentieth annual report of the Society states that further accommodation has been made to the library, giving increased facilities in the selection of books. The Corn Exchange Committee have lent the Exchange for the opening and other lectures of the present season. In order to make the building available for lectures, an outlay of about £5 was absolutely necessary, and a further similar sum will be required if the building is continued to be used for all or the more popular of the Society's lectures.

THE CONDITION OF MINES IN GREAT BRITAIN.

The report of the commissioners* appointed by her Majesty to inquire into the condition of all mines in Great Britain to which the provisions of the Act 23 and 24 Vic., cap. 151, do not apply, with reference to the health and safety of persons employed in such mines, has just been issued. The report occupies upwards of forty pages of a small blue book.

From a careful consideration of the evidence they have heard, and of the reports and documents prepared in the course of the inquiry, and from the knowledge acquired by visiting the districts and by inspecting mines threin, the commissioners have agreed to the following resolutions:—

"1. That there is a great excess of sickness and mortality among metalliferous miners, which is mainly attributable to the imperfect ventilation of the mines. However diverse the opinions of medical men may be as to the causes of the disease called 'miner's asthma' or 'miner's consumption,' there is a remarkable concurrence among all the writers on the subject in this, that the health of the miner is greatly influenced by the quality of the air in which he works. The more extended inquiry instituted by us under the royal commission gives strength, if not certainty, to this conclusion. In the coal districts, where, on account of the dangerous gases, great attention has been given to the proper ventilation of the mines, the mortality (accidents excepted) among the miners is considerably less than it is in the metalliferous districts. We have on this account thought it advisable to make ourselves acquainted with the systems of ventilation usually adopted in coal mines, in the hopes that we might thereby be able to offer some suggestions for improving the ventilation in the metalliferous mines. The main object to be kept in view in ventilating a mine is to conduct a sufficient supply of pure air through the mine in order to displace the vitiated air where the men are at work. Various contrivances have been put in practice for effecting this, but they are all applications of two principles, propulsion and extraction; by the first pure air is forced in, by the second foul air is drawn out. The power used may be either natural or artificial. Natural force acts when columns of air are, in the absence of any artificial means, of unequal weight, in which case the heavier column displaces the lighter, and so causes movement and change of air. Another natural force acts when the wind blows in at a level or over a shaft. Artificial propulsion is effected by various applications of machinery and other contrivances, such as falling water, the water blast, or the fan; artificial extraction, by suction or by furnace heating. The most simple method of ventilation is by natural agencies directed and supplemented by engineering skill. Two or more shafts or adits are essential, so contrived that one shall be upcast in all states of the

* The Commissioners were—Lord Kinnaird, Sir P. M. Grey Egerton, Nicholas Kendal, F. Leveson Gower, John St. Aubyn, R. Davey, E. Headlam Greenhow, and P. H. Holland, with J. F. Campbell, Secretary.

weather. A system of trunk ventilation being thus established the pure air may be guided to any part of the mine where it may be required, if care be taken to remove all refuse or 'deads,' and to close up all old and abandoned workings, by which the currents of air may be interfered with. In cases where natural ventilation is insufficient, artificial means must be resorted to, and of these it appears to us by far the most effectual, where it can be adopted, is that which is generally in use in the coal mines, namely, the rarification of the air in one of the shafts by the heat of a furnace. The mechanical means which have been suggested are the introduction of pure air by a force pump, and the abstraction of foul air by a suction pump. Machines for the latter purpose are in successful operation in some collieries and mines in this country. The foregoing remarks chiefly apply to the maintenance of a regular system of trunk ventilation. In small mines, and in certain parts of large mines, a good supply of air may be provided by means of contrivances which cannot be economically applied on a large scale, such as different descriptions of air pumps, water blasts, and fans. These may answer the purpose when judiciously applied and carefully attended to. It appears to us worthy of consideration whether some combination of natural with artificial appliances might not be adopted at a comparatively small expense, considering the benefit that would thence accrue both to the employer and employed. Cases have come before us of mines in which, in certain conditions of the atmosphere, the circulation of air underground is regular and sufficient, while at other times it varies both in quantity and direction, consequent upon the inversion or stagnation of the current of air in the shaft. This evil might be effectually conquered by the maintenance of a constant upcast shaft, and, where natural causes fail, this might be effected by an application of furnace heating. Whatever system, however, may hereafter be adopted, it is essentially necessary that attention should be paid to driving the levels of sufficient size, to making more frequent communications between them, to removing the refuse, closing up disused winzes, sumps, shafts, and abandoned workings, and to the judicious application of air-tight doors and brattices so as to control the direction of the underground currents.

"2. That several other causes, both general and local, largely contribute to impair the health of the miner—namely, exposure to cold and wet, and to sudden alternations of temperature; wearing wet clothes, inhalation of gritty particles; and the exertion of climbing ladders from great depths.—Amongst the causes enumerated by the medical men as tending to impair the health of the miner, exposure to sudden alternations of temperature to wet and cold is much insisted upon. The miner is peculiarly liable to these dangers, either from imprudence on his own part or from want of proper arrangements on the part of his employers. Another cause most injurious to the health of the miners is the exertion of climbing ladders continuously from great depths. The evidence of the medical witnesses and of the miners themselves leaves no doubts on our minds as to the pernicious effects of severe climbing upon men whose constitutions are, perhaps, impaired by the conditions under which they work, and the severity of the work itself. This evil is occasionally enhanced by the impure state of the air in the ladder ways, and aggravated by the indiscretion of the miners themselves, especially the younger ones, in mounting the ladders with too much haste. In those mines where the man engine has been in operation the improvement in the health of the miners is stated to be evident. In most coal mines workmen are conveyed up and down the shaft in the 'cage.' This arrangement appears to us to be expeditious and safe, when due attention is paid to the construction and supervision of the machinery; and we think it might be advantageously introduced in many of the metalliferous mines. We therefore recommend—1. That every mine should be provided with proper houses conveniently situated, in which the men can change and dry their clothes. 2. That surface work should, as far as practicable, be carried on under shelter, and that suitable places should be provided in which women and children employed at the mines might take their meals. 3. That in order to avoid the evils consequent an climbing ladders, mechanical means should be provided to convey the men to and from the surface when the mines are of great depth.

"3. That accidents are of frequent occurrence in metalliferous mines, and that they principally result from miners falling from ladders and stemples, or from one level to another; from falls of the rock or stuff; from want of caution in blasting; from defective gear and imperfect supervision of machinery; from sudden irruptions of water or foul air, and from the bursting of boilers.—To obviate as far as possible the various accidents to which miners are exposed, we recommend,—1. That no ladderway should be allowed in a drawing shaft without the shaft being properly divided or bratticed off from the footway, and that efficient sollars should be fixed at moderate distances in all footways, whether the ascent or descent be by ladders or stemples. 2. That shafts, winzes, sumps, and shoots should be more carefully guarded. 3. That more stringent rules should be enforced in regard to blasting, with a view to preventing accidents, and that bronze tamping rods and prickers should be supplied to the men. 4. That the persons having charge of the footways and other works underground should daily enter in a book a report of their condition to the agent or captain of the mine, which should be produced in case of inquiry. 5. That the boilers and other machinery should be periodically examined by the mine engineer, and that a monthly report thereon should be given in to the captain or agent, to be produced by him should occasion require. 6. That the men should not be allowed to change in the boiler house, which none but those in charge should be permitted to enter. 7. That all boilers should be provided with two safety valves and a water guage or a steam whistle. 8. That plans and working sections of all mines on their being abandoned should be deposited at the office of the clerk of the peace for the county, and at the Government Mining Record Office in Jermyn-street, for reference in case of working being resumed, or new mines opened ud in the immediate vicinity.

"4. That abandoned shafts, and old works unprotected at the surface, are a cause of serious danger, not only to the miner, but to the public.—The accidents consequent upon the practice of leaving abandoned shafts and works insufficiently guarded or wholly unprotected, are so numerous that we think it very desirable that an efficient and easily available legal remedy should be provided in order to guard the public from this prolific source of danger.

"5. That the employment of boys underground at an early age contributes to produce disease and premature death.—We therefore think it desirable that, as a general rule, no boys under the age of fourteen years should work below the surface.

"6. The system of mine clubs as at present in general operation is unsatisfactory, as not providing for cases of sickness as well as of accident.—We therefore suggest the adoption of such a system of mine clubs as would afford the men sufficient maintenance during sickness as well as while suffering from the effects of accident."

Manufactures.

Silk Manufactures of Switzerland.—The export of silk goods in 1862 was 35,412 cwts., which was much more than any preceding year, than even 1859, which was considered a very favourable one. Most of the coloured silk stuffs are made, Bâle being chiefly celebrated for its ribbons. The newly-invented aniline dyes are rapidly taking the place of the figured silk for ribbons. Some

idea of the work done at the dyeing establishments can be formed, when it is stated that one, Mr. Clavil, of Bâle, turns out 90 cwts. of dyed silk per week, and pays away in expenses about £20,000 a-year. There are thirty-one ribbon manufactories at Bâle, and two for stuffs. By far the largest number of weavers are employed in their own houses. The proportion of looms is about 1,500 in factories and 6,000 dispersed in different parts of the country. The silk industry of Bâle may be considered as a vital occupation for the town. On this more than 10,000 persons, or a fourth part of the town population, subsist.

PAPER IN DENMARK is for the most part of very inferior quality; protected under the old tariff by a high import duty upon foreign manufacture, and an equally high export duty on rags. This manufacture is represented by 18 mills, only six of which are of any importance.

PREPARATION OF FLAX.—A French manufacturer, named Bertin, has invented what is reported to be a successful method of dispensing with the steeping of flax. After the fibres have been crushed in the ordinary way, M. Bertin submits them to a new process, that of friction between two channelled tables, which have a sideway as well as to-and-fro motion; in fact, the action is similar to that of rubbing the fibres between the palms of the hands, but under considerable pressure and with great rapidity. The fibre is afterwards beaten in water, which carries off every particle of woody matter and leaves the flax completely unbroken and in parallel masses. The principle of friction tables has been applied by M. Bertin in other cases, and is said to furnish an economical, rapid, and perfect mechanical action. The same gentleman has adopted a new system of chemical steeping to get rid of the resinous and other matter which attaches the fibres together, which is said to produce the required effect in less than two hours, at a cost of about 1s. 8d. per cwt., leaving the flax nearly white; but the particulars are not given. By M. Bertin's system it is affirmed that the yield of flax is raised from 12 or 15 to 20 or 22 per cent. of the gross material. Lastly, M. Bertin collects the refuse beneath his crushing machines, burns it in his boiler furnaces, and uses the ashes and the water in which the flax is steeped as manure, giving back, as he affirms, the whole of the mineral salts and azotised matter contained in the crop, and the cost of so much artificial manure saved to the cultivator.

DIS FIBRE.—The Jury of the Exhibition of 1862 awarded a medal to M. Lafon de Caudaval for his specimens of paper and yarns prepared from the plant called *Dis* by the Arabs, and by botanists, *Festuca patula*, *Arundo festucoides*, *Arundo mauritanica*, or *tenax*, and its claim to the attention of the commercial world is being prominently put forward in France. It is reported to grow spontaneously on the coast of Algeria, over an extent of 250 leagues, and is said to yield 84 per cent. of fibre, 6½ per cent. of gluten for use as tapioca, and 9½ per cent. of water and herbaceous elements. The fibre is applicable to the making of paper, coarse fabrics, and cordage, and is not subject to the attacks of insects. For paper making it is treated in the same manner as rags. For the extraction of the gluten the crushed plant is steeped for three or four days in lime water, and afterwards for the same period in an acidulated solution; this disengages carbonic acid gas, which, in escaping, exercises, apparently, a kind of mechanical action in completing the separation of the fibres, and these are afterwards beaten in water by machinery. The average length of the Dis fibre is given at nearly five feet, and the cost of the prepared flax at about 4s. 6d. per cwt.

Commerce.

PIRACY OF TRADE MARKS.—A deputation from the committee of the Association of Chambers of Commerce, joined by delegates from the Birmingham, Sheffield, and Wolverhampton Chambers, had an interview on Friday, the 11th instant, with Mr. Layard, Under-Secretary of State for Foreign Affairs, in order to impress upon her Majesty's Government the injury to be apprehended from the provisions in reference to trade marks contained in the Franco-Prussian and Anglo-Prussian treaties of commerce. The deputation consisted of Mr. Sampson S. Lloyd, of Birmingham, chairman of the Association of Chambers of Commerce; Mr. Atkinson, Master Cutler, of Sheffield; Mr. Robert Jackson, president, and Mr. W. Smith, secretary of the Sheffield Chamber of Commerce; Mr. H. W. Ripley, president of the Bradford Chamber of Commerce; Mr. Robt. Fletcher, Mr. Yates, and Mr. Bartleet (Redditch), of the Birmingham Chamber; and Mr. Loveridge and Mr. E. J. Gibbs, of the Wolverhampton Chamber. The deputation pointed out in detail the dangerous effect of the second portion of the 28th article of the Franco-Prussian treaty, which legalises for ever the piracy of all trade-marks whose origin is anterior to their registration in the country of importation, whose registration could not take place until about two years ago. The injurious effect of the clause upon the interests of honest manufacturers in France itself was demonstrated; and the strongest testimony was borne by gentlemen from Sheffield, Birmingham, and Redditch, as to the ruinous results to be apprehended from its operation on the hardware manufactures of this country. Numerous specimens of German forgeries of the marks of eminent British makers, which are publicly sold in large quantities in various continental countries and in America, were shown. The deputation urged upon her Majesty's Government to make use of such facilities as they possess to represent to the French Government the injurious consequences of the clause, in order, if it be not too late, to obtain its modification in the Franco-Prussian treaty. It was also hoped that in any direct negotiation between Great Britain and the Zollverein a clause would be introduced providing for the efficient protection of all British trade marks; and failing that, the opinion was unanimously expressed that the treaty would be more valuable if the second clause of Article 28 were altogether expunged.

FRENCH IMPORT DUTY ON SILK RIBBONS.—The Liverpool Chamber of Commerce have received a communication on this subject from the Foreign-office, to the effect that, in virtue of the treaty lately concluded between France and the Swiss Confederation, the French import duty on silk ribbons has been reduced from 8f. to 4f. per kilogramme, a decrease of 50 per cent., the advantages of which will be shared by British industry as soon as the Franco-Swiss convention comes into operation.

COMMERCE OF JERUSALEM.—"Jerusalem," observes the British Consul in his annual report to the Foreign Office, "is the least commercial or industrial city I know. British trade is represented by one English tradesman, who keeps a store for English upholstery, drapery, and fancy goods. The population of the city is computed at 15,000, rather more than half of them Jews, the rest Moslems and Christians. The chief native industry is the manufacture of soap and "Jerusalem ware," this latter consisting of chaplets, crucifixes, beads, crosses, and the like, made for the most part at Bethlehem, and sold to the pilgrims, who annually flock to the holy city to the number of about 6,000. The population of the entire Sandjak, or province, is estimated at 200,000, of whom 160,000 are Mahommedans. Owing to the absence of good roads and the insecurity arising from the predatory tribes of Bedouins inhabiting the outskirts of the district, but who could easily be kept in check, vast and fertile plains lie waste or are but partially and poorly cultivated; factories are not to be met with, and no mines are worked, though it is believed that sulphur, bitumen, and rock salt abound on the shores of the Dead Sea. The principal, if not the only imports from England are cotton goods, and some colonials, but the former have much diminished since the cotton crisis; it is calculated

that 300 bales of these goods, of the value of £16,000, annually find their way here. The exports are olive oil and grain. Very little is done in cotton culture, what is raised being of inferior quality, and consumed on the spot; but it is believed that in many parts of the country cotton to a large extent might be successfully cultivated, with good seed and proper instruction and implements given to the peasantry. The vegetable produce is barely sufficient for local requirements. Jaffa is the port through which Jerusalem deals with foreign countries. The trade of Jaffa experienced a considerable increase in 1863. The quantity of cotton exported rose from 55,000lbs. in 1862 to nearly ten times the amount in 1863, with a prospect of this being trebled or quadrupled in 1864. This was owing to the interest exercised. The merchants who operated in cotton made a profit of about 25 per cent. There are regular lines of French, Austrian, and Russian steamers, all doing well, and very often large quantities of goods have to be left behind for want of room; but only one English steamer visited Jaffa in 1863, The exports exceeded £200,000; of the imports no statistics are kept. The consul reports a telegraphic line in course of formation by the Government between Beyrout and Jaffa, thence to be carried on to Alexandria.

Colonies.

Victoria.—The Border Customs question has assumed an aspect which promises some trouble to the Governments of Victoria and New South Wales, and some inconvenience to the inhabitants of the Riverine district and the merchants who trade with them. The Murray River Railway will be finished in the course of three or four weeks. Echuca, the township on the Victorian side of the river, will then become the port for the trade of the vast plains which stretch northwards to Cooper's Creek, watered by the Lachlan, the Murrumbidgee, the Warrigo, and other rivers. These plains, however, are within the limits of New South Wales and Queensland, and as the tariff of Victoria is much more liberal than that of New South Wales, the Sydney Government proposes that the Victorian authorities should collect the extra duties on goods sent across the Murray from this colony, handing the amount over to the Treasurer of New South Wales, on payment of a commission for collection. This course the Victorian Government refuses to take, requiring, it is understood, some concessions as to the navigation of the Murray. In the meantime some half-dozen customs' officers have been stationed at points on the northern bank of the river, with instructions to seize all goods coming from Victoria on which the New South Wales tariff charges have not been paid. The question has been embarrassed by the fact that a wrong has been committed on Victoria, when her boundaries were fixed, in some manner never yet satisfactorily explained. When separation was proposed the river Murrumbidgee was named as the northern boundary of this colony. A dispatch from Lord John Russell shows clearly that the Home Office assented to that line; but when separation was accomplished, it was discovered that the southern bank of the Murray had been substituted for the Murrumbidgee. As neither government is likely to give way in this matter, and the protective principles which find favour in Sydney are opposed to the views entertained in this colony, and there is no probability of the tariffs being assimilated, the course which has been taken therefore is likely to lead to smuggling to a large extent, and the creation of a class of borderers who, in this respect at least, may rival those of the Tweed and the Solway. In commercial matters the state of the colony is sound.

Royal Society of Tasmania.—The monthly meeting of this Society was held at Hobart Town on the 9th August, but the proceedings have only just been published. A number of returns were laid on the table, together with several presentations. Mr. M. Alport having reported that the salmon and trout in the breeding ponds were proceeding in a perfectly satisfactory manner, read a paper on the food for salmon in the Tasmanian seas and rivers. Mr. Gould exhibited a map, geologically coloured, of a part of the county of Dorset, and gave a brief description of the distribution and extent of the more important formations. He commented on the absence of the carboniferous and the abundance of granite and older palæozoic rocks. In speaking of the expansions of semi-waste low land, bordering on the coast, he referred to a tufaceous limestone which crops out in thin ledges along the same bank which forms part of the tertiary deposits at Table Cape and Macquarie Harbour, and cited them as showing that the recent elevation of the island had been greater upon the northern than upon the southern side. After pointing out the courses of the more important ranges, he gave a short account of the fertile basaltic areas of Scott's country; he also alluded to the efforts that have been made to discover gold at Nine Mile Springs, and the Devil's Den, referring more especially to the latter as exhibiting gullies of some promise, and pointing out that the work hitherto performed had been perfectly insufficient to afford any test as to the existence of gold, only a few men being employed, and the work performed by them having been in part ineffective, from an injudicious selection of the spot tried.

South Australian Revenue.—The *S. A. Advertiser*, of the 26th of August, 1864, says:—The revenue for the year ending June the 30th, was £693,840; the expenditure £600,666; the colonial bonded debt, £840,000. The imports for the last quarter amounted to £682,762; for consumption in the colony, £610,160; the total exports of south Australian produce for the same quarter, £670,013.

Revaluation of Australian Land.—The great question of the day, and one that almost totally excludes all other business, is that of the revaluation of the runs, the leases of which expire in 1865. About 200 of these leases will then fall in, and as the valuator has increased the rental of the first eighteen about sevenfold, the squatters have taken alarm. But even this enormous increase will leave the lessees in possession of the finest grass lands of the province at 6d. per annum per acre. By the 10th of September all the runs situated in the northern parts of the province of South Australia, about eighty in number, will be revalued. There has been no such struggle for many years.

Wine.—California will make 1,500,000 gallons of wine this year.

Cochineal in Australia.—At a meeting of the Acclimatisation Society of New South Wales, held in August, 1864, Mr. Moon announced that the cochineal insect had at last reached the colony alive. For many years past he had used every effort towards obtaining this object, but until then without success. He had had the insect sent to him from America, Madeira, and England, but it had in each instance perished before it had arrived. The society is now indebted, for the introduction of this valuable insect into the colony, to Sir George Grey, Governor of New Zealand. The insect feeds upon the *Cactus opuntia*, and, as a matter of course, the cacti without spines, of which there are several species in the colony, are the most useful.

Obituary.

Hudson Gurney.—On Wednesday, the 9th of November, died Hudson Gurney, of Keswick, near Norwich. His life was protracted beyond the usual space allotted to man. When he was born, Joseph the Second had not long ascended the Austrian throne, nor had Frederick the Great made that journey into Silesia which brought about his end, and the female Tiberius, Catherine, consoled her-

self for the loss of Lanskoï by her secret marriage with Potemkin, and her selection of the subaltern Yermoloff. Arrived at manhood, Mr. Gurney assumed the position he may be said almost to have inherited, and added to that position by his intellectual qualifications, which gave him the right of association with Byron and Coleridge, Shelley and Keats, Wordsworth and Southey, Scott and Hook. The subject of this notice was born in the year 1785, and, had he lived till January next, he would have reached the great age of 90. He was a ripe scholar, and possibly the best read man in Norfolk. At an early age he obtained a seat in Parliament, and originally sat for the Rape of Bramber, Sussex, and afterwards was M.P. for Newport, in the Isle of Wight. A serious illness brought about a change of ideas, and Mr. Gurney resigned his seat in the House of Commons, and settled down into the quiet charms of domestic life. His income was reputed to be enormous; but, enormous as it was, his charities kept ample pace with its receipt. He appeared to live only with the one idea, and that was, the doing good. He was a patron of art and an elegant and accomplished scholar. It is asserted, and it is believed with much truth, that he expended upon charity as much as £10,000 per annum. There are many men who possess as great qualities as Mr. Hudson Gurney, many who have performed greater actions; but few like himself, reared in the lap of fortune, have ever so persistently and perseveringly entered into the affairs of the poor, and so instinctively, as it were, identified their interest with his own. For many years he had retired from public life. His habits were somewhat singular, since he sat up writing or reading, it is said, through the entire night, generally retiring to bed at daybreak. It is stated that several valuable works from his pen lie on the bookshelves at Keswick Hall; and it is hoped, now that the author is no more, they will be given to the world. The little that is known of the literary capabilities of Mr. Hudson Gurney shows him a man of great intellect; and his translation of the "Cupid and Psyche" of Apuleius is a sufficient proof of the stuff that was in him.

The Death of Mr. J. R. M'Culloch, on the 11th of November, is the loss of a valuable public servant and a distinguished man of letters. He had been for some time past subject to attacks on the chest of a dangerous tendency, and his last seizure a few days since proved fatal. From its commencement he gradually declined in strength, but retained all his faculties till his last moments. Mr. M'Culloch was born in Wigtonshire, on the 1st of March, 1789, and he was, therefore, in his 76th year. His father possessed a small freehold estate in that county, and was of the class of small proprietors in the English border counties denominated "statesmen"—cultivators of their own acres. The son received from his maternal grandfather, a Scotch minister, his early education; that is, he was "grounded" in his mother tongue, with some elementary instruction in the dead languages after the then Scotch fashion. On leaving school Mr. M'Culloch was placed in the office of a writer to the signet, but he did not pursue the profession of the law. He settled in Edinburgh and attended the public classes of the University for two years, but did not graduate or study for any profession. Early in 1817 an accidental communication of Mr. M'Culloch's to the *Scotsman* (then first established) led to his connexion with that journal, and for some time he was the editor. In the following year he commenced a series of contributions to the *Edinburgh Review*, and also gave lectures on political economy, In 1820 Mr. M'Culloch quitted Edinburgh for London, continuing his contributions to the *Scotsman* for some years, but contributing also to other periodical works and giving lectures on political economy. In 1828 he was appointed professor of that science in University College, London; but, the chair being unendowed, the number of students attending his lectures was insufficient for his remuneration, and he resigned the professorship. In 1838 the Government appointed him Controller of the London Stationery-office, at a salary of £1,000 per annum, and he continued the head of this department till his death. When he undertook its administration the Stationery-office was an Augean stable. The long and habitual waste of paper in the consumption of the public offices and in printing was fabulous. Mr. M'Culloch accomplished a large annual saving, far exceeding the cost of the department he presided over. By his stern economy and hatred of "jobs" he of course created enemies; but his judicious savings and integrity were undisputed, and are matters of record in Parliamentary reports and returns. Mr. M'Culloch's more lasting and meritorious reputation, however, was gained by his literary labours. They were the result of forty years of study and experience. Statesmen had attended his lectures in London, and his contributions to periodical works had been various and diffuse. But he now began to realize his acquirements. In 1837 Mr. Charles Knight published, in two 8vo. volumes, his *Statistical Account of the British Empire*. This valuable work was subsequently republished by Messrs. Longman in successive editions much enlarged. The latter publishers brought out his *Dictionary of Commerce and Commercial Navigation*—a standard work annually reprinted and revised. These two works may be considered his staple productions, and they were reprinted in the United States and translated in several European countries. His miscellaneous works were numerous, and all more or less valuable contributions to political and economical science. In 1828 he edited for Messrs. Longman, in four vols. 8vo., the best edition of Smith's *Wealth of Nations*, with a life of the author, an introductory discourse, notes, and supplementary dissertations. In 1853 he published a volume of *Treatises and Essays on Economical Policy*, comprising sketches of Quesnay, Adam Smith, and Ricardo. This work was partly a republication of articles contributed by the author to the *Encyclopædia Britannica*, but all were carefully revised and in part re-written, some essays appearing for the first time. In the same year appeared his volume on the *Principles of Political Economy*, lastly corrected and revised. In 1855 he published his treatise on the *Principles and Practical Influence of Taxation and the Funding System*. In 1858 he also published a valuable work on the "Succession to Property vacant by Death; including inquiries into the influence of primogeniture, entails, and compulsory partition upon the public interests." Mr. M'Culloch collected a library on his own special subjects of great value. It contained not only almost every known English word on political economy and statistics, but every foreign publication on those subjects, and it comprised every pamphlet, known or anonymous. In 1855 he published a bibliographical volume on the literature of political ecocomy, a catalogue of his best books, with historical, crititical, and biographical notices; and only two years since he completed and privately printed a more extended and valuable catalogue *raisonné*. Of the latter volume a very few copies were presented to personal and literary friends. The motto on the title-page of this volume was from Barrow:—"The reading of books, what is it but conversing with the wisest men of all ages and all countries, who thereby communicate to us their most deliberate thoughts, choicest notions, and best inventions, couched in good expression, and digested in exact method?" The genius of Mr. M'Culloch was not inventive. He sifted and re-cast the labours of others. Statistics, rather than the principles of political economy, were his *forte*; but his works were generally lucid and sound. He occasionally indulged in paradox; but in this error he only followed Malthus, Whately, and Senior. There are unsolved problems in political science; and men of genius in advance of their generation, groping in the dark, must sometimes lose their way. Mr. M'Culloch was an original member of the Political Club, and he assisted Lord Overstone in the publication of his lordship's miscellaneous tracts on political economy. In social life he was hospitable, genial, and warm-hearted, and was

esteemed by a large circle of friends who will deeply lament his loss.

Notes.

Prince Consort Memorial.—The artists entrusted with the execution of the sculpture of the Prince Consort Memorial in Hyde Park, are the following:—Messrs. Foley, Macdowell, Marshall, Weekes, Bell, Theed, Thornycroft, Lawlor, and Baron Marochetti. The four principal, or lower groups, for the four outer corners of the base of the structure, and representing the four quarters of the globe, are—Europe, by Mr. Macdowell; Asia, by Mr. Foley; Africa, by Mr. Theed; and America, by Mr. Bell. The four upper, or secondary groups, are—Agriculture, by Mr. Marshall; Manufactures, by Mr. Weekes; Commerce, by Mr. Thornycroft; and Mechanics, by Mr. Lawlor. The statue of the Prince is to be executed by Baron Marochetti, and the relievos by Mr. Philip and Mr. Armstead.—*Athenæum.*

Royal Society.—The Copley, Royal, and Rumford medals have this year been awarded as follows:—Copley Medal: Mr. Charles Darwin, F.R.S., for his important researches in geology, zoology, and botanical physiology. Royal Medals: Mr. Jacob Lockhart Clarke, F.R.S., for his researches on the intimate structure of the spinal cord and brain, and on the development of the spinal cord; Mr. Warren De La Rue, F.R.S., for his observations on the total eclipse of the sun in 1860, and for his improvements in astronomical photography. Rumford Medal: Dr. John Tyndall, F.R.S., for his researches on the absorption and radiation of heat by gases and vapours. It is especially satisfactory to find the work of a philosopher, who, like Darwin, is not only the author of numerous monographs of the most varied as well as the most valuable description, but has revolutionised biology by the introduction of new fundamental conceptions, so early and so fully recognised by the Council of the Royal Society.

Abyssinia.—M. Lejean, Vice Consul of France at Massaona, has just returned home, having recovered his liberty from the prisons of the Emperor of Abyssinia in September last. It took him five weeks to travel from Gondar to Massaona. M. Lejean gives a sad account of the French expedition under M. Bisson, which has been a total failure, and of which the members are in a state of the utmost misery, and thinking of nothing but how they shall find their way home. On his way home, M. Lejean visited a corner of the Nubian Sondau, governed by a Circassian, Monça Pacha, and afterwards went to Halaï by a new route to the country of Zenadéglé, where he was able to rectify several errors which had crept into the last charts by Petermann. M. Lejean brings back with him some documents said to be of great archæological interest, concerning Adulis and other points of the Sampar coast. He is said also to have discovered several necropoli, and to have found seven Axoumite medals, which are so rare that there are said only to be five in all the European collections known. They bear the head of the sovereign on one side, and the Cross of Abyssinia on the other. He promises to publish shortly a map of the country of the Bogos, and some ethnographical information. M. Lejean is of opinion that a Greek colony was once established at Adulis and its neighbourhood.

Correspondence.

Revised Code.—Sir,—The task of criticising the public acts of a department of the State is one of difficulty and delicacy; and the more so, that we have every reason to believe that the one we criticise is one originating in a kindly desire to promote the great object we in common have at heart, and recommended by those who have given their most earnest attention to the subject. To such, let us hope, however, that a line of fair and candid reasoning will be acceptable, and that anything that we may say will be fairly weighed and favourably considered. There is, it would appear to me, at the bottom of the whole subject involved in the Government payments in aid of schools, a question of the greatest importance, viz.:—Is it, or is it not, the duty of the State, either directly or indirectly, as a separate question to be afterwards determined, to educate, or provide for the education of its children. The State interferes in much smaller questions than this. It will not let me burn my hay-rick, if I thereby risk the hay-rick of my neighbour. It compels me to pay towards the support of the criminal and the suppression of crime. It compels me to provide medical attendance, and sick and old age allowance, for the pauper, although he may have spent and wasted his property and thrown himself upon my industry. Is not the duty of educating as strong as either of these? Is not prevention, if we look at it in this light only, better than cure? Is the soul or the body the subordinate part of us? If it be the duty of the State to educate, or, at least, to provide education, as I think must be admitted, let us then claim to be exempt from the unjust and unworthy charge that we are grasping at the aid of the State, that we are seeking to rob its coffers, when we, as volunteers whose services it accepts, are doing its work, and when the obligation clearly rests, not with that party which, in a spirit of true love, throws itself into the work, but with that which is benefited by the work and whose duty is all but gratuitously done for it by zealous and willing hands. In approaching, then, the question of the Revised Code, we should bear this position in mind, and look at it in the abstract, not whether the State should provide or supplement education, but whether the plan proposed by the Revised Code is the best for the performance of its duty. It is a very large question. We are living under a constitutional government which, in the eye of the law, recognises no class, but provides for and desires that the talent, of whatever class, however humble, should rise to the surface for the service of the State, and that every facility should be given to it. Again, in the eye of the same just laws, all are equal, and, whether born in a village or a town, we have a right to the same advantages, to the same development of talent. All contribute to the taxes. All have a right to the same advantages. The thoughtful and intelligent observer of our constitution will not question this; the justifier of class legislation or class education only will treat it as theory. We are not born to that class of life in which it has pleased God to place us, or many would be still peasants who are most justly among the highest and most distinguished of the land. Education, aiding their own talent, has raised them. Let us not then repudiate the means which has exalted and distinguished our nation, or kick down the ladder by which the wisest and greatest have risen to eminence. Such is my preface to the question of the Revised Code as an instrument, for as such only can I deal with it, and in doing this I am obliged to contrast it with its predecessor. Both were experiments, tentative experiments, as regards the promotion of education, but not, I am disposed to think, as regards the officers employed. We are trying new kinds of artillery and new armour for ships, but this would hardly justify the withdrawal of the pay of our officers or their dismissal; and I confess that I think that this applies, and with a stringent force, to those whom we have encouraged to devote themselves to a new profession, and promised a fixed and settled payment so long as they continued in that profession. But I pass this by for those to adjust whose duty it is to do so, and on whom the responsibility of carrying out the engagements of the country lies. I refer to it only because I look upon the salary of the certificated master or mistress as an apt and satisfactory means of adjusting the claim to which I have already alluded, viz., that of all classes of the country, whether rural or urban, to the same advantages, and to the same chance of rising to the surface and into

eminence by the cultivation of the talents with which God has endowed them. A poor country parish had a chance, by the choice of a high class of teacher, whose Government payment on his certificate came in aid of the poverty of the place, of securing the teaching which the local resources could not secure. In taking away this resource, or throwing it on the managers—which is the same thing—and reducing all possible payments to a question of head money, the Revised Code comes in aid only of those who ought least to want it, and starves those poor small places which are struggling under a difficulty in which the State denies them any sympathy. While talking, but a short time since, on the working of the Code, and expressing my regret at the reduction of at least one-half of the receipts in rural parishes, I was told that it worked admirably in London, and in the parish in which I then was, in which they had largely increased their receipts. But that parish includes some of the largest and handsomest squares in London, and we may safely put them as 50 houses in each square, in each of which no one could pretend to live under an income of £4,000 or £5,000 a year. Here it works well, and the receipts are largely increased. I will not enter on the question of population as a basis, but simply express my conviction that it is a most fallacious one, and that there is no large population where larger aid cannot be had by a zealous clergyman than in a poor but moderate-sized village. I am quoting the figures of the Archbishop of York, in his admirable address on the subject, when I say that "small populations take little advantage of the Government regulations" and that while of large parishes only $8\frac{1}{2}$ per cent. are without Government aid, of the smaller parishes, under 500 population, 91 per cent. are without this aid, and that while 3,851 parishes are reached, 11,024 are untouched and unaided. The comparatively few populous parishes are aided, which I have endeavoured to show least require aid, while the smaller and poorer and most numerous parishes, to which the requirements act necessarily as a bar, are left to their own resources. Let me pass on, that I may not occupy too much time, to the question of the standard requirements of the Revised Code. Perhaps, under the old code, elementary mechanical instruction was not sufficiently insisted on. I say perhaps, and speak with some reserve, because it is almost necessary, before we determine this, that we should determine what we mean by education. I must not enter into this, nor take up any defined line of argument, but simply assume that it means the discipline and instruction of the mind through the agency of its perceptions and faculties. I will not for a moment trust myself to believe that there can be understood by any one such an education as will enable an infant of six or a boy of ten years to do his duty in that class of life in which it shall have pleased God to place him. If a labourer, a labourer; if a mechanic, a mechanic; perpetuating, or trying to perpetuate, the very worst evils under which any country can labour, the evils of caste, or class, and degradation. Assuming education to mean discipline and instruction of the mind, there is a mean, it would appear to me, between disregarding the mechanics of education, if I may use the expression, as applied to R. W. A., as was the case when it was said by some that they cared not whether the boy could write or spell well if he could give intelligent answers, and that system which insists primarily and almost wholly on this elementary work, to the exclusion or disregard of the awakening of intelligence. The practical educator knows the variety of taste and character he has to deal with, and that he has not really struck the first note until he has found, in some special taste or inclination, the key-note on which the whole course of education depends. To one child some particular work is specially irksome; to a second, another; while each has a particular taste or inclination which may be profitably cultivated. Now, doubtless, discipline requires that these should be wisely and judiciously dealt with, but the division of labour also requires a principle to which this country owes so much that they should have fair play. The greatest mathematicians, the greatest classics, the greatest lawyers and statesmen, have not always been the best writers. The men of science or inventive skill have not always been the best arithmeticians. The greatest divines and the most eloquent statesmen have not always been good readers. Indeed, in higher life, all these branches of education on which we almost exclusively insist, are grievously neglected. What, then, is the object of this low standard to which, after so short a trial of the old code, we have reverted? Is it not to lower the standard of education, and, as it were, convulsively to struggle out of a difficulty which we have ourselves created, without considering the effect it must necessarily have upon those anxious to raise the standard of education, and upon those struggling with the difficulties of poverty and the narrow-minded views of certain classes amongst our agricultural population? It may be said, therefore, and I think fairly, that the Revised Code has had an injurious effect upon the cause of education. The old code may have been imperfect; indeed, it was so; and in its provisions precocious and inconsiderate, but still it had a greater effect than that which has succeeded it, in raising the education of the country; and everything teaches us, from the great and Divine Exemplar of our holy faith to the humblest legislator, that if we wish to raise our poor fallen humanity, we must take a high standard, and set it in all its fulness before the world. On another ground, I think that we have fair reason to complain of the Revised Code, viz., that it does not carry out its own principle—the payment by results. If this principle were fairly and fully carried out, it might be the means of helping the poorest schools, where active and intelligent masters and managers cordially co-operating with them, produced the results contemplated by the Code; but a bar is put to this by the Council's requirements, and by that ingenious sophistry which has transferred the engagements and liabilities of the Government to the shoulders of the managers, under the pretence of its being necessary to protect those very claims and rights of the masters which they have created and now disregard. The Archbishop of York, in his address, to which I have already alluded, speaks of there being no reduction in the number of pupil teachers. It may be so, and I cannot dispute the correctness of his Grace's information, but there has hardly been time for this to show itself, and I cannot help fearing that it will show itself not only in the number, but in the inferiority of the class, whenever time has been allowed to develope the consequences of the change. Everything is in the downward scale. The money saved—the teaching lowered with the class and tone and standing of the teachers—and we cannot wonder if the vision of a well-taught, well-instructed people, adapted to an age of machinery and science, pales before the argument of £ s. d., which fulfils, but too often, the adage of being "penny wise and pound foolish." We may squander in the punishment of crime what we might most righteously economise in its prevention, and pay highly for much degradation and depravity, which criminal statistics, unquestionable and uncontrovertible, show that we might have saved, by a sound education—not by reading, writing, and arithmetic, the miserable skeleton—the dry bones of education—but by the enlargement of the faculties—the cultivation of taste and the creation of that thirst for knowledge as a resource, which is what the Christian educator will strive to attain.—I am, &c., S. B.

Study of Geometry.—Sir,—In reference to Mr. J. Culverhouse's letter contained in the Society's *Journal*, 624, Nov. 4th, 1864, wherein he asks "why Euclid is still retained as a school book on the subject of the science of geometry?" which he considers "is rendered unnecessarily abstruse," and "ill adapted to our youth," and in which remarks I concur, I have only now to observe that a book exists containing all of the most useful theorems (not

"theories") and problems of Euclid, which are rendered so exceedingly simple in the demonstrations thereof, as to almost reach the point aimed at by your correspondent, viz., "the results given simply as observations and rules." The book I allude to is Dr. Hutton's "Course of Mathematics," the 1st vol. of which contains the desiderata in question.—I am, &c., T. S. BURT.

18, Wilton-place, N.W., Nov. 7th, 1864.

MEETINGS FOR THE ENSUING WEEK.

MON. ...R. Asiatic, 3.
R. Inst. of British Architects, 8.
Medical, $8\frac{1}{2}$. Mr. A. Balmanno Squire, M.B., "On Diseases of the Skin caused by the Acarus." 2. Mr. Henry Lee, "On different Modes in which Constitutional Syphilis may be communicated."

TUES. ...Anthropological, 8.
Ethnological, 8. 1. Captain Burton, "On the Ethnology of Dahome." 2. Mr. T. S. Prideaux, "On the Principles of Ethnology."
Civil Engineers, 8. 1. Discussion "On the Decay of Materials in Tropical Climates." 2. Mr. E. H. Clark, "Description of the Great Grimsby Docks, &c."

WED. ...Society of Arts, 8. Dr. William Fairbairn, "On the Application of Iron to the Purposes of War and Naval Construction."
Archæological Assoc., $8\frac{1}{2}$. 1. Dr. Brushfield, "On Roman Intaglios found at Petriana, on the Great Wall of Hadrian." 2. Mr. Pettigrew, "On Sepulchral Crosses at Ilkley and in the neighbourhood of Leeds." 3. Mr. Syer Cuming, "On Forged Antiquities in Bronze."
Geological, 8. 1. Sir W. E. Logan, "On the Occurrence of Organic Remains in the Laurentian Rocks of Canada." 2. Dr. J. W. Dawson, "On the Structure of certain Organic Remains from the Laurentian Limestones of Canada." 3. Mr. T. Sterry Hunt, "On the Mineralogy of certain Organic Remains from the Laurentian Limestones of Canada." Communicated by Sir W. E. Logan. 4. Mr. W. Keene, "On the Coal-measures of New South Wales, with Spirifers, *Glossopteris*, and *Lepidodendron*." Communicated by the Assistant-Secretary.

Patents.

From Commissioners of Patents Journal, November 11th.

GRANTS OF PROVISIONAL PROTECTION.

Ammonia, manufacture of—2526—R. A. Brooman.
Anchors, construction of—2604—F. Martin.
Artillery, projectiles for—2622—W. Pitts.
Battens—2630—J. Smith.
Blast furnaces—2639—R. A. Brooman.
Boot and shoe making, manufacture of—2563—J. Brownhill.
Brewing and distilling, apparatus employed therein—3598—W. L. Tizard.
Buttons, &c.—2610—G. Davies.
Capes, &c.—2624—J. Emary.
Carriages, &c., reducing the friction of moving parts of—2562—M. Henry.
Chain cables, working of capstans, &c.—2600—W. H. Harfield.
China, articles of—2524—L. Clauss.
Clay, moulding the same into bricks and tiles—2636—J. Heap and T. Jolley.
Cotton pods, breaking the husks of—2554—E. Tomlinson and J. Jones.
Cotton, spinning and doubling—2508—W. B. Haigh and S. Barlow.
Envelopes—2556—A. D. Dhe.
Fabrics, woven—2496—J. Collinge.
Fire-arms and cartridges—2602—G. Davis.
Gas and atmospheric air, carburation of—2560—J. Cassell.
Houses, chimneys and flues for—2542—W. H. Kelsey.
Indigo, method of obtaining from textile materials—2156—J. F. P. Hugounenq.
Iron, manufacture of—2581—W. Taylor, H. Harrison, and G. Brown.
Jute—2654—R. Hart and J. F. Calder.
Lace, dressing—2345—W. Carter.
Ladies' skirts—2579—J. C. A. Henderson.
Lamps, wick and chimney holders for—1670—B. Whitehouse and C Priestland.
Looms for weaving—2640—S. Shaw.
Matches, &c., receptacles for—2620—G. Betjemann, G. W. Betjeman, and J. Betjemann.
Metals, cleaning and polishing the surfaces of—2354—G. P. Wheeler and J. F. Gloyn.
Metals, pressure to the rolling and drawing of—2520—M. A. F. Mennons.
Moulding and planing wood, machinery for—2608—H. Wilson.
Piles, driving and drawing—2528—J. Robbins.
Postal and other purposes, stamping applicable to—2606—C. H. Gardner and C. English.
Powder magazines for storing, &c.—2628—R. Hookham.
Projectiles—2015—J. H. Huxley.
Propellers—2626—E. E. Colley.
Pumps—2548—W. E. Newton.
Railways, signalling on—2638—J. Tate.
Railway trains, signalling on—2616—J. Scarisbrick.
Rotary engines—2596—W. E. Newton.
Screw jacks, &c.—2625—A. Muir.
Screw presses, &c.—2617—A. Muir.
Sea wrack grass, treatment of—2522—E. Moride.
Signals or alarums—2558—T. Corbett.
Slicer, bean—2530—J. Batkin.
Smelling bottles—2658—Charles May.
Steam boiler, consuming smoke in—2632—R. A. Brooman.
Steam-boilers—2550—F. Wise.
Stoves, construction of—2534—A. Hippius.
Sulphuric acids, concentrating and distilling—2634—W. Clark.
Textile fabrics, composition for waterproofing, &c.—2656—P. A. Le Comte de Fontainemoreau.
Titanic iron sands—2650—B. F. Brunel.
Tubes, securing in tube sheets—2170—E. R. Lloyd and S. Lloyd.
Wax, preparation of artificial—2552—W. Clark.
Weaving ornamental fabrics—2652—J. Cunningham and R. Cunningham.
Woven fabrics, manufacture of—2592—W. H. Ablett and J. B. Baine

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Corks, &c.—2716—W. Davies, G. Cate, and W. Cate.
Rivets, fastening of—2746—G. Haseltine.

PATENTS SEALED.

1217. M. Henry.	1264. J. Combe and J. H. Smalpage.
1228. A. Fryer.	1280. C. Minasi.
1229. L. Bricout.	1947. F. Thornton.
1234. W. Reid.	2122. R. W. Thomas.
1236. W. Wilson.	

From Commissioners of Patents Journal, November 15th.

PATENTS SEALED.

1243. R. A. Brooman.	1304. H. Wimshurst.
1244. G. Hunter.	1318. G. T. Bousfield.
1245. W. Rowan.	1325. J. W. Lees.
1247. P. Bawden, and J. and S. Williams.	1349. J. Young.
1249. H. A. C. Boulenger.	1364. J. Sykes.
1254. J. B. Merrikin.	1366. O. E. Prieger.
1259. J. Browning.	1412. H. A. Bonneville.
1262. T. Dunlevie and J. Jones.	1506. P. Spence & H. D. Pochin.
1263. W. Bauer.	1509. J. H. Johnson.
1267. W. R. Harris.	1519. J. H. Johnson.
1269. J. Frazier.	1573. W. Clark.
1272. E. Wilson.	1596. H. Chamberlain, J. Craven, and H. Wedekind.
1274. E. A. Cowper.	1944. A. Long.
1275. S. R. Dickson.	2252. A. V. Newton.
1279. J. Belham & G. Valentine.	2262. S. A. Baron.
1291. M. P. W. Boulton.	2263. S. A. Baron.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2809. J. Byrne.	2834. W. J. Hay.
2821. E. Loysel.	2883. J. C. Goodall and J. Beale.
2826. W. Tongue.	2854. T. Proctor.
2827. D. Y. Stewart.	2877. E. Loomes.
2833. C. O. Crosby.	2878. W. E. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2842. J. Harrington,	2909. J. Clarke.
2843. H. C. Bartlett.	

Registered Designs.

Ladies' Safety Pocket—Sept. 30—4661—Alfred Chas. Hawes, 35, Dame-street, Packington-street, Islington.
A Purse—Oct. 5—4662—C. G. Arnold and Co., Leipzic, Germany.
Utilitarian Boot and Shoe Stud Rivet—Oct. 15—4664—John Cadwallader, Madeley, Shropshire.
Chadburn's Lanterns for producing enlarged images upon a screen, &c., similar to the magic lantern, from opaque bodies, engravings, drawings, photographs, reliefs, natural objects, and for dissolving the same images one into another—Oct. 19—4665—Charles Henry Chadburn, Liverpool.
Latch for doors, cupboards, and other articles—Oct. 21—4666—William Tonks and Sons, Birmingham.
Grass Cutting Machine—Oct. 22—4667—William Smith, Barnard Castle, Durham.
A Glove Fastener—Oct. 24—4668—J. W. Williams, Worcester.
A Set of Fastenings for the Stay Busk—Oct. 24—4669—Drew and Son, Bath.
The Fragrant Cloud Maker, or "La Bouffée Odorante et Frigorifique"—Nov. 11—4670—Messrs. Piesse and Lubin.
A Double Laundry Trough—Nov. 14—4671—Thos. Bradford, Fleet-street.
A Tobacco Pipe—Nov. 14—4672—James McAlpin, 28, Victoria-street, Manchester.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, NOVEMBER 25, 1864. [No. 627. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

Nov. 30.—"On the Mechanical Conditions of Railway Working to Prevent Destructive Wear and Risk." By W. Bridges Adams, Esq.

Dec. 7.—"On the Construction, Retardation, Safety, and Police of Railway Trains." By W. Bridges Adams, Esq.

Dec. 14.—"On Irish Industries; and the Irish International Exhibition of 1865." By Sir Robt. Kane.

Cantor Lectures.

There will be three Courses of "Cantor" Lectures on the following subjects during the ensuing Session:—

"On the Reproduction of Natural Forms by Art and Manufacture." By B. Waterhouse Hawkins, Esq., F.G.S., F.L.S.

"On the Application of Geology to the Arts and Manufactures." By Professor D. T. Ansted, M.A., F.R.S.

"On the Application of Chemistry to the Arts." By Dr. F. Crace Calvert, F.R.S.

The following is a syllabus of Mr. Hawkins's course, with the dates of delivery:—

Dec. 12th.—Lecture I.—Introductory:—On the nature and probable influence of museums of natural history and art collections, and their effect on the public mind and taste. (Illustrated.)

Dec. 19.—Lecture II.—Demonstrations of the unity of plan in the external forms of animals, the just appreciation of which facilitates the work of the artistic producer, and adds to the enjoyment of the intelligent possessor of works of art.

Jan. 16th, 1865.—Lecture III.—On the varieties of artistic treatment of the forms of animal and vegetable life—pictorial representation; conventional ornamental, allegorical, and symbolic combinations of animal forms.

Jan. 23rd.—Lecture IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

Jan. 30th.—Lecture V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture.

Proceedings of the Society.

Second Ordinary Meeting.

Wednesday, November 23rd, 1864; The Duke of Somerset, K.G., First Lord of the Admiralty, in the chair.

The following candidates were proposed for election as members of the Society:—

Barker, Charles Stuart, 12, Buckingham-street, Adelphi, W.C.
Durham, Makin, Thorne Hall, Thorne, Yorkshire.
Gale, William Joseph, 32, Torrington-square, W.C.
Hale, William, 6, John-street, Adelphi, W.C.
Kirchner, John, Peckham-common, S.
Partridge, William, 48, Newgate-street, E.C.
Pistrucci, Valerio, 28, Camden-street, N.W.
Pite, Frederick Robert, 38, Bloomsbury-square, W.C.
Pitman, E., 2, Ledbury-road, W.
Pittar, Arthur, 4, Kensington Park-gardens, W.
Rowlands, Percy Jones, 24, Notting-hill-terrace, W.; and India Office, Westminster, S.W.
Slater, Robert, 104, Fore-street, E.C.
Smith, William Binns, 7, New-square, W.C.
Thompson, F., South Parade, Wakefield.
Tichborne, Sir Alfred, Bart., Tichborne-park, Hants, and 13, James's-street, Buckingham-gate, S.W.
Todd, William, 24, Wellington-road, St. John's-wood, N.W.
Tozer, Thomas, 55, Dean-street, Soho, W.
Van de Weyer, M. Sylvain (Belgian Minister), 3, Grosvenor-square, W.
Venning, Walter C., 9, Tokenhouse-yard, E.C.

Verschoyle, Colonel H., 23, Chapel-street, Belgrave-square, S.W.
Wilson, George, Cyclops Steel and Iron Works, Sheffield.
Wingate, James Forman, Club-chambers, 15, Regent-street, S.W.

The Paper read was—

ON THE APPLICATION OF IRON TO THE PURPOSES OF NAVAL CONSTRUCTION.

By Wm. Fairbairn, Esq., LL.D., F.R.S.

From the earliest period of history to the present high state of civilisation, we behold a long and interesting succession of improvements in the construction of weapons of war. Man in his savage state contrived instruments of aggression as well as defence. Tomahawks, spears, and arrows composed of wood, shod with stone or bone, were adopted. As he advanced in civilisation, and became acquainted with minerals, he had recourse to a rude description of manufacture by reducing the ores and extending their uses to the purposes of peace as well as to the art of war. In fact, he found that the application of heat to the iron ores produced a semifluid or ductile mass, that could be drawn or consolidated, under a series of blows, into the required forms calculated to supply his wants. It was in this way that the early workers in iron—the Tubal Cains of former days—produced weapons for attack and defence. No doubt they would soon find—once the discovery was made—that iron, at different degrees of temperature, and under different conditions of time and the heat to which it was exposed, would assume the different forms of rigidity, ductility, &c.; and, without any knowledge of combined carbon, oxygen, &c., as known in modern times, they actually found, at a later period, that a certain process, under these conditions, produced steel, from whence the famous weapons known as the "Blades of Damascus" were made.

From these early stages of manufacture to the middle of the last century, we have little to boast of in the production of iron and steel. Something was certainly done during this long interval, but we have no traces of any important improvement until 1784, when Cort first introduced his invention of the puddling furnace and the rolling of plates and bar iron. Hammered iron plates were occasionally made, but seldom used unless for special purposes; and it was not until the introduction of rolls that anything in the shape of rolled plates could be obtained. At that time, and for several years subsequently, little or nothing was done to encourage the manufacture, but the new process of rolling simplified the operation and gave greatly increased facilities for the manufacture of this important article of commerce. Rolled plates were first employed in the construction of boilers; and those of the haystack form were made as early as 1786, and were chiefly employed for raising steam for the atmospheric pumping engines of Cornwall, and those for the collieries of Northumberland and Durham. More recently, or about the same date, Mr. Watt introduced the waggon-shaped boiler for his reciprocating sun and planet-wheel engine, but we have no traces of iron boats or ships at a date antecedent to that of Cort and Watt.

At the commencement of the present century it is more than probable that the first construction of iron canal boats took place; and we have evidence of their existence in Staffordshire about the year 1812 or 1813. From that time to the present iron boats have been successfully employed on canals.

From 1812 to 1822, to use a more familiar expression, there was an interregnum of progress for a period of ten years, and we hear nothing of iron as a material for ship-building, till the Horsely Company built the *Aaron Manby*, which was sent to London in sections, reconstructed in one of the docks, and navigated to Havre and Paris by the late Admiral Napier.

It was supposed that the success of the *Aaron Manby* would have stimulated exertions in the same direction, but important discoveries, like other things of great magnitude, require time to bring them to maturity, and another period of rest ensued, from 1822 to 1829, when a new discovery was made by Mr. Houston, of Johnstone, near Paisley, in which it was found that a light boat, with two horses, had sufficient power to convey passengers on a canal at the rate of nine to ten miles an hour. This discovery was made at a time when a new and important era in the history of transit on railways burst unexpectedly upon the public in the experimental tests and competitive trials of locomotive engines at Rainhill. The results of these trials created alarm in the minds of all the canal proprietors of the kingdom. They became anxious about their property; and the speed of ten miles an hour, as attained by Mr. Houston in his gig-boat, was the only gleam of hope left to enable them to meet, with anything like success, the alarming and powerful competition of the rail and locomotive.

Things were in this state when the governor and council of the Forth and Clyde Canal employed the writer to institute a series of experiments to determine the law of traction, and account for the phenomena of the absence of surge at high velocities on canals. These experiments were conclusive and interesting, and the report was published shortly afterwards, at the request of the governor and council of the Forth and Clyde Canal Company. In this report will be found a detailed account of the experiments and the conclusions and recommendations arrived at, the most prominent of which were the introduction of iron vessels and steam on the locomotive principle as a substitute for horses. Acting upon this recommendation four steam vessels were constructed at Manchester, one a twin-boat, with the paddle-wheel in the centre, and a second, the *Lord Dundas*, with the paddles recessed into the dead wood of the stern. The first was an experimental boat, but the second plied for several years as a passage boat between Port Dundas and Lock 16.

Simultaneous with these vessels another and a larger iron vessel, 84 feet long and 14 feet beam, with recessed paddles in the stern, was also built at Manchester in 1831, and navigated through the locks of the Mersey and Irwell to Liverpool, and from thence to Greenock. This was the second iron vessel that put to sea, if we except the *Lord Dundas* light boat, which performed the same voyage from Liverpool to Glasgow in the previous year. The name of this vessel was the *Manchester*, and for many years it was employed as a coasting vessel, carrying goods and passengers between Port Dundas, Grangemouth, and Dundee.

During the time of these constructions Messrs. John and MacGregor Laird were engaged in similar undertakings for the Irish canals, and were present at most of the experimental trials of light boats on the Irwell. These boats were built at Birkenhead, and forwarded in sections to Ireland. About the same time, or shortly after the Manchester canal boats were introduced on the Forth and Clyde Canal, Messrs. Laird built the *Alburka*, a small iron vessel, that went out to Africa with the Landers and Mr. Mac Gregor Laird, for the exploration of the Niger. The whole of these vessels were confirmatory of the great superiority of iron over wood as a material for ship-building; and we have only to refer to the extensive use and enormous increase that have taken place in its application, not only in this country, but in every maritime state of the globe, to be convinced of the soundness of the principles and the great superiority of the iron ship.

Having briefly noticed the origin and subsequent improvements that have taken place in iron ship-building, it is important that the naval architect should have all the information that can be obtained, and for this purpose we have on this very important question to direct attention to the following divisions of the subject:—

1st. The strength of plates when torn asunder by a direct tensile strain in the direction of the fibre, and when torn asunder across it.

2nd. On the strength of the joints of plates when united by rivets as compared with the plates themselves.

3rd. On the resistance of plates in varied forms of construction to the force of compression.

And lastly. On the distribution, strength, and value of wrought-iron plates and frames as applied to ships and other vessels.

On the first of these, where the iron plates were torn asunder in the direction of the fibre and across it, the following results were obtained:—

TABLE I.

DESCRIPTION OF PLATES.	Mean breaking weight in the direction of the fibre in tons per square inch.	Mean breaking weight across the fibre in tons per square inch.
Yorkshire Plates	25·770	27·490
Yorkshire Plates	22·760	26·037
Derbyshire Plates	21·680	18·650
Shropshire Plates	22·826	22·000
Staffordshire Plates	19·563	21·010
Mean.........	22·519	23·037

From the above it will be observed that the average strength of plates is about 22½ tons to the square inch, the maximum being in favour of the Yorkshire plates, and the minimum those of Staffordshire.

It would probably be unfair to class plates with bar iron of the same quality, as bar iron is much more elongated and drawn into fibre in passing through the rolls than the same material when drawn into plates; we may, however, compare plates with bars experimented upon by the late Mr. Telford, who found, in his experiments to determine the strength of different irons previous to his construction of the Menai Suspension Bridge, that out of nine fagoted specimens, selected from the Swedish, Welsh, and Staffordshire irons, he obtained a tenacity of 29·25 tons per square inch.

	Tons.	
Captain Brown's experiments for the same purpose gave.........	25·00	per sq. inch.
Minord and Desames'	25·00	,,
Yorkshire plate experiments ...	24·50	,,
Shropshire plates	22·82	,,
Derbyshire plates	21·68	,,
Staffordshire plates	20·32	,,
Giving a mean tenacity for plates of	23·22	tons per sq. in.

Comparing this with the strength of bar iron from the best material, and making allowance for the latter having been worked, rolled, and drawn into fibre to a greater extent than plates, the difference in strength is not so great as might have been expected, being in the ratio of 29 : 23 or 1 : ·8 nearly.

Plates of ordinary manufacture, or such as are used in ship-building, seldom exceed 20 tons to the square inch. Unfortunately, many of these are considerably under that mark, but on no account should any plate be allowed to enter into the construction of a sea-going vessel under a tensile strain of from 20 to 22 tons per square inch. Small vessels, such as boats for canals and rivers, may venture upon an inferior standard of quality, but even with this allowance there is no economy in the use of bad material, which is neither safe nor durable.

DUCTILITY, ELONGATION, &c.—We have already noticed that ductility is a property highly valuable in iron, and, we may add, when combined with tenacity it becomes more so; in fact, ductility is the true measure of strength and of its practical utility. These properties being of great importance in the manufacture of iron, it may be useful to give a few examples, derived from recent experiments, illustrating the principle on which it is supposed that good iron yields and becomes attenuated when acted upon by forces which draw it in the direction of the fibre.

It has been stated that iron, like most other metals, is of a ductile character. In this respect, however, it is inferior to gold, silver, and platinum, but it is in advance of copper, zinc, and tin, and may be considered superior to any of these metals on account of its tenacity, and from this we derive its adaptation to the art of construction and its value as an article of commerce. Iron is, therefore, of inestimable value, and, combining properties such as those enumerated, it becomes one of the most important and useful of metals.

The following experimental results were derived from seven different thicknesses of iron plate. They were obtained from four different firms, and marked A, B, C, and D, as under:—

A. Six specimens of iron plates.
B. Seven specimens.
C. Seven specimens, homogeneous metal.
D. Seven specimens, rolled iron.

The whole of these specimens were torn asunder by a tensile strain, and recorded in the following summary:—

TABLE II.

Summary, giving mean Tensile Strength of each Series of Plates, or Statical Breaking Strain.

Approximate thickness of the Plates in inches.	TENSILE BREAKING WEIGHT PER SQUARE INCH OF SECTION.				Mean of Plates of the same thickness in tons.
	A Plates.	B Plates.	C Plates.	D Plates.	
inch.	tons.	tons.	tons.	tons.	tons.
¼	24·344	24·167	30·703	17·470	24·171
½	25·750	23·220	33·694	11·055	23·430
¾	...	29·432	30·913	26·473	...
1½	24·158	22·299	26·197	25·158	24·453
2	25·348	23·657	27·038	24·634	25·169
2½	24·110	23·921	27·506	22·732	24·569
3	25·039	23·540	27·386	24·159	25·031
Mean of thin plates	25·047	25·606	31·770	18·333	...
Mean of thick plates	24·644	23·354	27·032	24·171	...
Mean of all of one make ...	24·792	24·319	29·063	21·669	..

The order of merit in the thinner plates is, (1) C; (2) B; (3) A; (4) D. With thicker plates it is—(1) C; (2) A; (3) D; (4) B. The mean of the whole gives (1) C; (2) A; (3) B; (4) D.

The homogeneous metal plates exhibit throughout the highest tenacity, but the tenacity decreases as the plates are made thicker. Of the iron plates, those marked A are most uniform in strength, the extreme difference being 1·64 tons. The B plates vary to the extent of 7·133 tons, and the D plates 14·103 tons, but the quarter and half-inch plates of the latter series would appear to have been burnt or injured in the manufacture.

Taking the means given in the last column, we see that in the average there is no great difference between the thicker and thinner plates. The extreme variation in these means is 1·74 tons. If we compare these means with the corresponding mean densities, there is an evident correspondence, thus—

	Density.		Tenacity.
1½ inch plates......	7·7471	...	24·453
2-inch plates	7·7684	...	25·169
2½-inch plates......	7·7660	...	24·569
3-inch plates	7·7666	...	25·031

Here the density and tenacity increase and diminish together. The same correspondence will be found, gene-

rally speaking, in each individual case on comparing the two tables, but there are exceptions in the case of the D plates. Taking into account the fact that the specimen employed in obtaining the specific gravity was cut at a distance of about 10 inches from the part broken by tension, the coincidence is sufficiently striking. The comparison holds good if we take the means of plates of the same manufacture, with one exception—

	Density.		Tenacity.
A plates	7·8083	...	24·644
B plates	7·7035	...	23·354
C plates	7·9042	...	27·032
D plates	7·6322	...	24·171

Table III.

Summary, giving the ultimate elongation per unit of length.

Approximate thickness of the plates in inches.	Ultimate Elongation per Unit of Length.				Mean of Plates of the same thickness in tons.
	A Plates.	B Plates.	C Plates.	D Plates.	
Inch.					
$\frac{1}{4}$	·0620	·0300	·2560	·0080	0·0890
$\frac{1}{2}$	·0760	·0400	·1000	·0111	0·0568
$\frac{3}{4}$	..	·1000	·2080	·0400	0·1160
$1\frac{1}{2}$	·1763	·1462	·1925	·1925	0·1769
2	·3050	·2525	·3450	·1788	0·2703
$2\frac{1}{2}$	·2880	·3200	·2950	·1600	0·2658
3	·3200	·2650	·2575	·2333	0·2689
Mean of thinner plates ...	·0690	·0566	·1880	·0197	...
Mean of thicker plates	·2723	·2459	·2725	·1913	...
Mean of all the plates	·2046	·1650	·2363	·1176	...

In this table the order in which the different series of plates stand with reference to ultimate elongation nearly coincides with the order in which they stand in reference to tenacity if the means of plates of the same manufacture are compared; but, on the other hand, if we compare the means of plates of the same thickness, we find that on the whole the ultimate elongation increases as the plates become thicker, whilst no law of this kind could be perceived in the mean tenacities.

Mr. Mallet has introduced a new co-efficient of strength of considerable importance in these inquiries, namely, the dynamic resistance to rupture, or foot pounds of work done in rupturing the material. This may be estimated with sufficient accuracy by multiplying the breaking weight in lbs. by half the ultimate elongation, and from thence we derive the following results:—

Table IV.

Mr. Mallet's Co-efficient or work done in causing rupture, corresponding with resistance to impact.

Approximate thickness of the plates in inches.	Foot Pounds of Work Causing Rupture.				Mean of Plates of the same thickness.
	A Plates.	B Plates.	C Plates.	D Plates.	
inch.					
$\frac{1}{4}$	1690·5	812·0	8802·7	156·5	2865·4
$\frac{1}{2}$	2191·8	1040·2	3773·7	137·4	1785·8
$\frac{3}{4}$	...	3296·5	7201·5	1186·0	3895·0
$1\frac{1}{2}$	4767·5	3651·3	5648·0	5424·0	4872·7
2	8659·0	6690·2	10448·0	4933·1	7682·6
$2\frac{1}{2}$	7776·8	8573·4	9087·2	4073·7	7377·7
3	8973·7	6987·0	7878·0	6312·7	7787·8
Mean of thinner plates ...	1941·1	1716·2	6592·6	493·3	...
Mean of thicker plates	7514·2	6475·5	8265·3	5185·9	...
Mean of plates of same make	5676·6	4435·8	8806·5	3174·8	...

It will be noticed that the numbers given in the case of the thinner plates are very variable, in consequence of the great fluctuations in the value of the ultimate elongation in those plates. This irregularity would have been eliminated if several specimens of each had been tried, or, still better, if the specimens had been so long that the elongation of a much greater extent of metal could have been ascertained. The results obtained in the thicker plates, with precisely similar round bars, are more uniform.

Bearing this in mind, the table exhibits several remarkable results. First, taking the means of plates of the same thickness, it appears that the dynamic resistance increases progressively as the plates increase in thickness; in fact, the thick plates exhibit $2\frac{1}{2}$ times the resistance of the thinner ones. The only exception to this general law is the quarter-inch homogeneous metal plate, which was extremely ductile.

Then, in the next place, it is to be observed, that the dynamic resistance increases with the thickness of the plates in a higher ratio in the iron plates than in the homogeneous metal plates, thus:—

Description of Plates.		Thinner Plates. Foot Pounds.	Thicker Plates. Foot Pounds.	Ratio.
A Plates	Iron.	1941·1	7544·2	1 to 3·82
B Plates	Iron.	1716·2	6475·5	1 to 3·77
D Plates	Iron.	493·3	5185·9	1 to 10·52
C Plates	Steel.	6592·6	8265·3	1 to 1·25

The result of this is that the superiority of the homogeneous metal to iron is very striking in the thin plates, but becomes less and less as the plates increase in thickness. Thus, taking the best of the iron plates, namely, series A, for comparison, we have the following ratios between the iron and steel:—

Thickness in Inches.	A. Plates	C. Plates	Ratio of Dynamic resistance.
	Foot-pounds.	Foot-pounds.	
$\frac{1}{4}$ inch	1690·5	8202·7	1 to 5·21
$\frac{1}{2}$-inch	2191·8	3773·7	1 to 1·72
$\frac{3}{4}$-inch		7201·5	
$1\frac{1}{2}$ inches	4767·5	5648·0	1 to 1·19
2 inches	8659·0	10448·0	1 to 1·20
$2\frac{1}{2}$ inches	7776·8	9087·2	1 to 1·17
3 inches	8973·7	7878·0	1 to 0·88

In this table we see that the ratio decreases progressively with great regularity from 1 : 5·21 to 1 : 0·88; that is, the work done in rupture is with $\frac{1}{4}$-inch plates five times as great with homogeneous metal as with iron, but the superiority decreases, and with 3-inch plates the resistance of the iron is 12 per cent. greater than that of the homogeneous metal. This result precisely corresponds with the results obtained in the trials with ordnance.* Thus, if we take the mean between the thinnest plate which resisted the shot of any given weight, and the thickest which was penetrated by it, as the maximum thickness of penetration with that projectile, we have from the experiments at Shoeburyness the following results:—

Rifled Gun.	Weight of Projectile in lbs.	Least thickness which would resist the shot in inches.		Ratio of resistance of plates of equal thickness.
		A Plates.	C Plates.	
Wall piece	0.344	0·87	1·62	1 : 1·97
Armstrong	6·25	1·25	1·15	1 : 1·18
,,	11·56	1·75	1·75	1 : 1·00
,,	24·81	2·25	2·50	1 : 0·81

* See Mr. Fairbairn's Experimental Researches, 1st Report of the Special Committee on Iron.

The results in this table are only roughly approximate; but they show a decreasing resistance in the C plates when compared with the A plates. The results in the last column strikingly correspond with those in the preceding table, if plates of the same thickness be compared. On comparing table 4, giving Mallet's coefficient, with the specific gravities, similar correspondence is observable to that already noticed in the case of tensile breaking strain. The exceptions also occur in the same series, namely, the D plates. Of the iron plates of different manufacturers, the A series throughout manifest the greatest amount of dynamic resistance. Next to it the hammered plates of series B, and, lastly, the rolled plates of series D. Taking the thicker plates, which give the most accurate results, and employing the iron plates of series A as a standard of comparison, we have the following ratio of dynamic resistance:—

A Plates	1000
B Plates	858
C Plates	1095
D Plates	688

The maximum difference amounting to 41 per cent. between C and D, and 31 per cent. between A and D.

To the above extract from the Report of the Special Committee on Iron, we may add the results of some experiments on the tensile strength of S C ♔ bars, conducted some years since at Woolwich, by Mr. Loyd, Inspector of Machinery. To that gentleman we are indebted for the following results:—

TABLE V.

Summary of Results, Tensile Strength of Bars.

Length of Bar in inches.	Diameter of Bar in inches.	Breaking Weight in Tons.	Elongation in inches.	Elongation per unit of length.
120	1·375	32·210	26·0	·216
42	1·375	32·125	9·8	·233
36	1·375	32·350	8·8	·244
24	1·375	32·000	6·2	·258
10	1·375	32·290	4·2	·420

In another series of experiments it was found that the continued strain of three-fourths of the breaking weight had no effect upon the bars, and that it might have been prolonged indefinitely without injury to the cohesive force by which the particles were united. These facts, although exceedingly interesting at the time, have since been carefully investigated, and, having to refer to them in the sequel, it will be sufficient for our present purpose simply to advert to the plastic nature of the iron by which the bars sustained an amount of elongation exceeding that of most other irons.

It appears from Table V. that the rate of elongation of wrought iron bars increases with the decrease of their length; thus, while a bar of 120 inches has an elongation of ·216 inch per unit of length, a bar of ten inches has an elongation of ·420 inch per unit of its length, or nearly double what it is in the former case. The relation between the length of a bar and its maximum elongation per unit of length, may be appropriately expressed by the following formula, viz.:—

$$l = \cdot 18 + \frac{2\cdot 5}{L}$$

where L represents the length of the bar, and l the elongation per unit of length of the bar. These results are of some value, as they exhibit the ductility of wrought iron at a low temperature, and also the greatly increased strength which it exhibits with a reduced section under strain.

2ND. ON THE STRENGTH OF THE JOINTS OF PLATES WHEN UNITED WITH RIVETS, AS COMPARED WITH THE STRENGTH OF THE PLATES THEMSELVES.—To ascertain the facts and to show how nature works in this direction, we are compelled to have recourse to the old but certain test of experiment. This appeared to me as the only certain method of arriving at truth in physical research. Resorting, therefore, to this expedient it will be necessary to note, what appears obvious to the most casual observer acquainted with mechanical constructions, that to unite plates together so as to make the joints as secure as if they were continuous and homogeneous in character is a desideratum. It would be desirable, for example, to have the longitudinal sheathing of our ships in strips or plates without joints; but this could not be done by welding, and here we have to resort to the expedient of uniting them together by bolts or rivets. Now it has been found that the latter process is by far the strongest and most endurable, as the rivets are generally put in hot and are hammered, or, what is decidedly preferable, compressed by the riveting machine into the holes prepared for their reception. A good rivet requires a head on each side, the same as a bolt and nut, but there is this difference, that the rivet becomes, when carefully inserted, part and parcel of the plate, and, when duly proportioned as to size and number, is equal in strength to the plate itself, minus the part punched out by the rivets. It is therefore desirable in every case where plates have to be joined that they should be united by rivets.

In ship-building, and in every other construction where wrought-iron plates form the principal material, it is essential that this part of the inquiry should be explicitly and clearly understood. It is therefore most desirable that the question should be thoroughly investigated, and that all those engaged in constructions of this kind should be fully aware of their importance, not only as regards the acquisition of knowledge, but the heavy responsibilities which attach to works on which the lives and property of the nation and of individuals depend. Impressed with these views, I may venture to submit to the engineer and naval architect the results of experiments which from time to time, and for a long series of years, have engaged my attention. In attempting to unite plates by the insertion of rivets we have to consider:—

1st. PUNCHING.—Now this is a very important part of the shipbuilding process, first, that the holes should be clean and well cut, and that by a perfectly flat steel punch; secondly, the holes in the plates when put together, should be coincident, and have a common centre, and should cover each other. To accomplish this, it is desirable that the punching should be done, if possible, by a self-regulating machine, but when this cannot be accomplished, the greatest care should be observed on the part of the workman to see that the punching is executed so as to bring the holes to coincide, and not incur the anomalous condition of having them half blind—as it is technically called—or nearly blind altogether—a circumstance which in rough imperfect work too often occurs.

It is much to be regretted that more attention is not paid to these operations, as inaccurate punching is seriously detrimental to the plates; and there is nothing which causes more injury to the security and tightness of the joints than bad riveting. The remedy chiefly in use by workmen as a compensation for the want of coincidence, is to drive through both holes a tapered steel pin, or drift, forcing and tearing the plate in every direction; and in order that they should obey the dictates of physical force as administered by a sledge hammer, in the hands of one whose muscular developments are greatly in excess of the reflective functions of his brain, the holes are enlarged, and the rivet very imperfectly closed, at an oblique angle to the face of the plate. This is a process which cannot be too much condemned, and appears to be the strongest argument against the punch. Some engineers, to avoid this evil, insist on having the holes in the plates drilled, but, according to our judgment, this system is better adapted to bolts than rivets, as the

drill makes a perfectly parallel hole, which is never so sound nor yet so secure as that which comes from the punch; and for this reason, that in punching a hole through an iron plate, it is not exactly cylindrical, parallel, or smooth, but the frustrum of a cone, and hence follows the superiority of the joint, as more closely incorporated with the plates. It will not be necessary in this place to determine the law by which this particular form is attained, suffice it to observe that the diameter of the punch is to the hole in the die as 1 : 1·15 or 1 : 1·20 for ordinary work, and we have therefore a hole in the plate or the piece punched out with oblique sides, the angles of which vary in the ratio of the thickness of the plates, and these with coincident holes form a sound and perfect rivet. Now this form of hole is not injurious but of great value as regards the strength of the joints, as the conical form of the holes is equivalent to a countersunk rivet on each side. It is moreover highly advantageous in ship-building, where the rivets are countersunk on one side, and where a perfectly smooth surface is required for the passage of the currents on the other.

To arrive at the strongest form of joint, it is necessary in this case to punch the plates so that the narrow sides of the holes are in contact. This is the more essential, as the heads of the rivets are easier formed, and the holes better filled, when performed either by the hammer or by compression. By the latter process—machine riveting—the joints are brought closer together by contraction as the rivet cools, and the adhesion of the two surfaces is greatly augmented.

Riveting.—During the early stages of iron construction, and as recent as the time to which we have alluded when iron shipbuilding was first introduced, there was only one system of uniting the joints of iron plates, namely, the overlap single-riveted joint. Now it is widely different, as the variety of purposes to which plates are applied renders a new and entirely different principle of riveting essential. When the double-riveted joint came into use is uncertain, but its advantages were first shown during the progress of my earlier experiments. These experiments were conclusive as to the value of the double riveted joint, but a new system of iron construction has been developed in the experimental researches which led to the form and construction of the Britannia and the Conway tubular bridges. In these structures it was imperative that the joints submitted to tension should be equal, or at least approximate closely to the strength of the solid plate; and after a great number of experiments it was found that the old system of single and double joint riveting was not only inapplicable but weak and insecure. This insecurity led to a more extended series of experiments, a summary of results of which I have now to record for the benefit of those who are not acquainted with the facts, and to whom it may be useful in the varied forms of construction as applied to iron ships and bridges.

General Summary of Results as obtained from Experiment.

No. of Experiments.	Cohesive strength of the plates. Breaking weight in lbs. per square inch.	Strength of double-riveted joints of equal section to the plates, taken through the line of rivets. Breaking weight in lbs. per square inch.	Strength of single-riveted joints of equal section to the plates, taken through the line of rivets. Breaking weight in lbs. per square inch.
1	57,724	52,352	45,743
2	61,579	48,821	36,606
3	58,322	58,286	43,141
4	50,983	54,594	43,515
5	51,130	53,879	40,249
6	49,281	53,879	44,715
7	43,805	...	37,161
8	47,062	...	...
Mean.	52,486	53,635	41,590

The relative strengths will therefore be—

For the plate 1,000
Double-riveted joint 1,021
Single riveted joint 791

From the above it will be seen that the single-riveted joints have lost one-fifth of the actual strength of the plates, whilst the double-riveted have retained their resisting powers unimpaired. These are important and convincing proofs of the superior value of the double joint; and in all cases where strength is required this description of joint should never be omitted. It appears when plates are riveted in this manner, that the strength of the joints is to the strength of the plates of equal sections of metal as the numbers,—

	Plate.		Double-riveted joint.		Single-riveted joint.
	1,000	:	1021	and	791
In a former analysis it was	1,000	:	933	and	731
Which gives us a mean of	1,000	:	977	and	761

which in practice we may safely assume as the correct value of each. Exclusive of this difference, we must however deduct 30 per cent. for the loss of metal punched out for the reception of the rivets; and the absolute strength of the plates will then be to that of the riveted joints as the numbers 100, 68, and 46. In some cases, where the rivets are wider apart, the loss sustained is however not so great; but in boilers and similar vessels, where the rivets require to be close to each other, the edges of the plates are weakened to that extent. In this estimate we must however take into consideration the circumstances under which the results were obtained, as only two or three rivets came within the reach of experiment; and, again, looking at the increase of strength which might be gained by having a greater number of rivets in combination, and the adhesion of the two surfaces in contact, which in the compressed rivets by machine is considerable, we may fairly assume the following relative strengths as the value of plates with their riveted joints:—

Taking the strength of the plate at 100
The strength of the double riveted joint will be 70
And the strength of the single riveted 56

These proportions may therefore in practice be safely taken as the standard value of joints such as are used in vessels where they are required to be steam or water tight, and subjected to pressure varying from 10 to 100lbs. on the square inch.

Rivets.—On this subject we have to consider the diameter, pitch, and length necessary to be observed in forming sound and tight joints without injury to the plates beyond the amount of metal punched out for the reception of the rivets. I have investigated this subject with great care, and, from my own personal knowledge and that of others, have collected a number of practical facts, such as long experience alone could furnish. From these data I have been enabled to compute the following table, which for practical use I have found highly valuable in proportioning the distances and strength of rivets in joints requiring to be steam or water-tight.

Table exhibiting the Strongest Forms and best proportions of Riveted Joints, as deduced from the Experiments and Actual Practice.

Thickness of plates in inches.	Diameter of rivets in inches.	Length of rivets in inches.	Distance of rivets from centre to centre in inches.	Quantity of lap in single joints in inches.	Quantity of lap in double joints in inches.
·19 = $\frac{3}{16}$	·38	·88	1·25 } 6	1·25	For the double riveted joint add 2-3rds of the depth of the single lap.
·25 = $\frac{4}{16}$	·50	1·13	1·50	1·50 } 6	
·31 = $\frac{5}{16}$	·63 } 2	1·38	1·63 } 5	1·88	
·38 = $\frac{6}{16}$	·75	1·63 } 4·5	1·75	2·00—5·5	
·50 = $\frac{8}{16}$	·81	2·25	2·00	2·25	
·63 = $\frac{10}{16}$	·94 } 1·5	2·75	2·50 } 4	2·75 } 4·5	
·75 = $\frac{12}{16}$	1·13	3·25	3·00	3·25	

The figures 2, 1·5, 4·5, 6, 5, &c., in the preceding table are multipliers for the diameter, length, and distance of rivets, also for the quantity of lap allowed for the single and double joints. These multipliers may be considered as proportionals of the thicknesses of the plates to the diameter, length, distance of rivets, &c. For example, suppose we take three-eighths plates, and required the proportionate parts of the strongest form of joint, it will be—

$\cdot375 \times 2$	$=$	·750 diameter of rivet, $\frac{3}{4}$-inch.
$\cdot375 \times 4\frac{1}{2}$	$=$	1·688 length of rivet, $1\frac{3}{4}$ inches.
$\cdot375 \times 5$	$=$	1·875 distance between rivets, $1\frac{7}{8}$ inches.
$\cdot375 \times 5\frac{1}{2}$	$=$	2·063 quantity of lap, single riveted joint, 2 inches.
$\cdot375 \times 5\frac{1}{2} + \frac{2}{3}$	$=$	3·438 quantity of lap, double riveted joints, $3\frac{1}{2}$ inches.

·75, 1·68, 1·87, 2·06, and 3·43 are therefore the proportionate quantities necessary to form the strongest steam or water-tight joints on plates three-eighths of an inch thick.

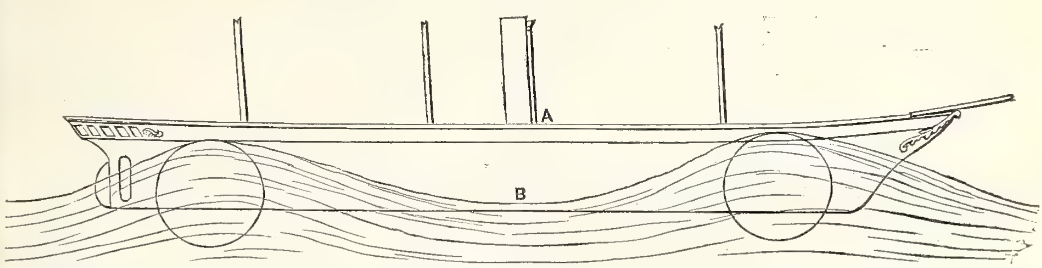
3rd. On the Resistance of Plates, as applied in Different Forms to the Force of Compression.—We have already noticed, when treating of the tensile strain to which a ship is subjected, that another equally important force is in operation in the movements of the vessel—that of crushing or compression. This is more apparent in iron than in wooden structures, as thin plates are liable to distortion when forcibly compressed in the direction of their lengths; and in ship-building, as in tubular girder bridges, this tendency to "pucker" requires to be carefully guarded against. When conducting the experiments for the Conway and Britannia Bridges, this weakness was strikingly apparent, and was carefully considered; and as the strains in that of a ship and a monster tubular girder are analogous, it is necessary in both structures that the resistances should be clearly understood, the two forces nicely balanced, and the tendency to buckle prevented.

To enable the practical ship-builder to acquire this knowledge, and become acquainted with the laws which govern iron structures of different forms, it will be necessary to investigate this question attentively, and endeavour to establish sound principles of construction in the minds of those who are entrusted with designs of such great public importance.

To construct a perfectly secure iron ship, every one of the transverse joints should be planed, in order that the ends of the plates may butt and form a solid joint. This connection is the more important, as the action of a vessel pitching at sea is a continued series of alternate strains of tension and compression. This motion is the most violent to which a vessel afloat is subject, and it is the most injurious to the structure. A vessel of war covered with armour plate, or a mercantile ship with a heavy cargo, plunges heavily at sea, and the waves meet her with violent shocks, so much so as to slacken her speed, and cause her to tremble or vibrate on the crest of the wave. This motion is somewhat analogous to that of rolling, but much more severe, as that part of the vessel which is left unsupported acts as a weighted lever on a transverse axis through the ship's centre of gravity, and thus produces severe strains at midships. By extending the weights or cargo in the direction of the bows and stern these strains are increased, and this, as a general rule, should be avoided by concentrating the cargo as much as possible at the centre of the ship.

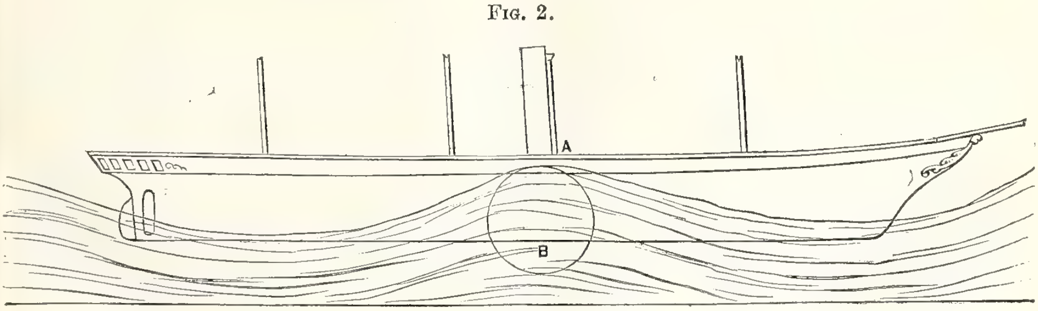
Let us suppose a vessel in the middle of the Atlantic or Pacific Ocean having to encounter a rolling sea in a storm, where the elevation from the trough to the crest of the wave is 24 feet, and the distance from point to point 380 to 400 feet; and, supposing that these waves move at a velocity of 10 knots an hour, and we have a vessel, as represented in fig. 1, with two waves, one at the bow and another at the stern, and her midships

Fig. 1.



partially unsupported, as if two liquid rollers (if I may be allowed the expression) were passing at the above rate under her bottom. In this position the strains would have a tendency to crush the material composing the upper deck at A, and to tear asunder the hull or bottom B. Hence the necessity for increased resistance in those parts. Reversing this position, and supposing that the liquid rollers or waves have passed from the bows and stern to the centre of the ship, and we have her balanced in the shape of a scale-beam as at fig. 2, with both ends only

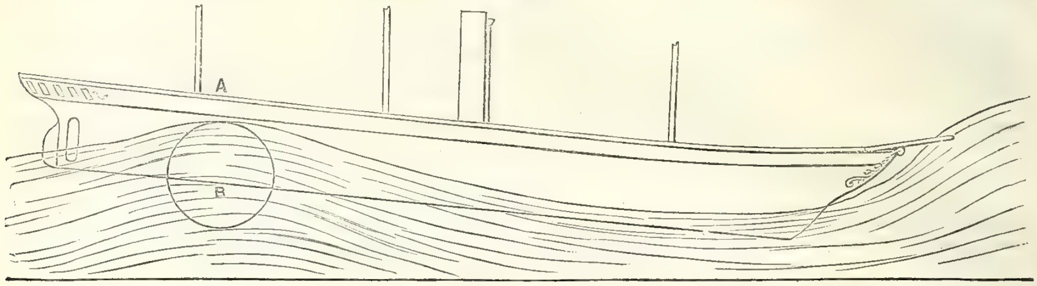
Fig. 2.



partially supported. In this position the strains are reversed, and we have the crushing force along the bottom as at B, and the tension or tearing force pulling at A on the upper deck.

Assuming, again, that the wave has passed from the centre of the vessel half-way to the stern, and we have the same forces continued, namely, the maximum of tension on the upper deck at the point A immediately over the apex of the surge, and compression at B below (fig. 3).

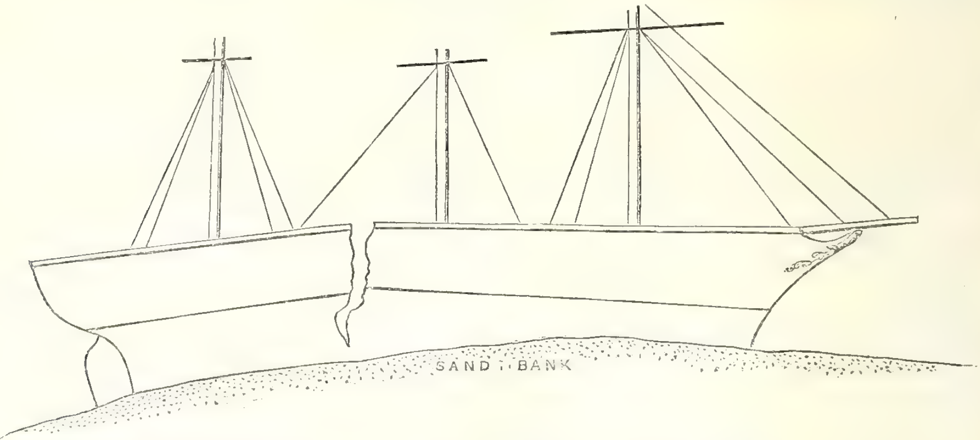
Fig. 3.



In these forms we have nearly all the disturbances and variety of strains, independent of rolling and wrenching, to which vessels are subjected when afloat. Under other circumstances, such as a vessel stranded on a lee-shore, beaten on rocks or sandbanks, similar forces of much greater intensity come into operation, and the only safeguard in these conditions is increased strength at midships and a sufficient number of water-tight bulk-heads, dividing the ship into five or six different compartments.

From the above it will be seen that alternate strains of varying intensity are continually in action during the time the vessel is plunging at sea with the whole of her cargo on board.

On the question of the strength of iron ships, we could not have a more striking illustration of the disastrous effect of defective construction, than that which took place in the case of the Montreal Ocean Mail steamer *Jura*, only a fortnight ago, which, by some mistake of the pilot, ran upon the Crosby-spit, a narrow sandbank, at the entrance of the Mersey. She was running full speed at the time. The fore part of her keel became fixed on the bank, the stern hanging in deep water, and the result was she parted at midships, as shown in the sketch, entirely for want of a judicious application of iron stringers on each side of the upper deck, calculated to balance the area of the hull at midships, and to resist the force of tension which tore her assunder on the upper deck.



On this very important inquiry of alternate strains, we are fortunate in having before us a series of experiments on the endurance of iron-jointed beams subjected to these changes. Not exactly similar to that of a steam engine beam, but a less severe test, arising from alternately reimposing and removing the load. This, it will be observed, was simply a constant change of tensile force in one direction, and compressive on the other, whereas that of a ship is subject to both tension and compression on the bottom and upper deck as she rises and falls upon the waves.

On referring to the experiments to which we have alluded, we arrive at this curious and interesting fact, that the joints of an iron riveted beam sustained upwards of 3,000,000 changes of one-fourth the weight that would break it, without any apparent injury to its ultimate powers of resistance. It, however, broke with 313,000 additional changes, when loaded to one-third the breaking weight, evidently showing that the construction is not safe, when tested with alternate changes of a load equivalent to one-third the weight that would break it.*

These results are probably not without interest as regards the construction of iron vessels, as they appear to be conclusive that time is an element in the endurance of structures when subjected to severe strains affecting their ultimate powers of resistance. It is difficult to determine or pronounce what is the correct measure of safety,

* *Vide* "Philosophical Transactions."

whether one-fifth or one-fourth the breaking weight, but we have sufficient data to be assured that every disturbance, however minute, in the molecular construction of bodies finally tends to their destruction, and it is only a question of time when rupture ensues. We may, however be assured that a ship, as well as a beam, is practically safe for a long series of years when the strains do not exceed five tons per square inch upon the wrought-iron plates of which it is composed.

Dr. Rankine has investigated this question, and in a paper read before the mechanical section of the British Association for the Advancement of Science at Bath, entitled, "On some of the Strains of Ships," he states that in previous scientific investigations respecting the strains which ships have to bear it has been usual to suppose the ship balanced on a point of rock, or supported at the ends on two rocks. The strains which would thus be produced are far more severe than any which have to be borne by a ship afloat. The author computes the most severe straining action which can act on a ship afloat, viz., that which takes place when she is supported midships on a wave crest and dry at the ends, and he finds that the bending action cannot exceed that due to the weight of a ship with a leverage of one-twentieth of her length, and the racking action cannot exceed about sixteen one-hundredths of her weight. Applying these rules to two remarkably good examples of ships of 2,680 tons displacement, one of iron and the other of wood, described by Mr. John Vernon, in a paper read to the Institution of Mechanical Engineers in 1863, he finds the following values of the greatest stress of different kinds exerted on the material of the ship:—In the iron ship—tension, 3·98 tons per square inch; thrust, 2·35; racking stress, 0·975. It follows that in the iron ship the factor against bending is between 5 and 6, agreeing exactly with the best practice of engineers, and that there is a great surplus of strength against racking. In the wooden ship—tension, 0·375 tons per square inch; thrust, 0·293. Here the factor of safety is between 10 and 15, which is also agreeable to good practice in carpentry. As for the racking action, the iron diagonal braces required by Lloyd's rules would be sufficient to bear one-third of it only, leaving the rest to be borne by the friction and adhesion of the planking.

From these inquiries it would appear that the strains are considerable on an iron ship—that for tension being 3·98, or 4 tons per square inch; thrust, or compression, 2·35 tons; and racking stress, 0·975 tons; evidently showing that a ship labouring at sea is subject to severe tests of repeated strains, independent of shocks which may occur from displacement of cargo or waves of greater magnitude, which generally succeed each other at certain intervals in severe gales. But be this as it may, it is necessary to have iron ships securely and strongly built.

Flexure and Crushing.—It has been ascertained that the effect of compression on any substance is to shorten its height and to enlarge its surface by increasing its bulk horizontally. Supposing, however, that the substance is confined and prevented from spreading in that direction, and it will then be found that the weight of one ton compresses wrought iron about $\frac{1}{10000}$ part of an inch; and in cast iron, which is much harder, we meet with this anomalous condition, namely, that a similar specimen is shortened or compressed $\frac{2}{10000}$ parts of an inch, being double that of wrought iron with the same weight. This arises, probably, from the porosity of its crystalline structure as compared with wrought iron, which undergoes a process of consolidation by hammering and rolling.

Another curious circumstance connected with wrought iron when submitted to compression is, that it will bear any amount of pressure provided it be sufficiently ductile. It, however, suffers distortion by a comparatively light weight, and its resisting powers are seriously injured with 12 tons per square inch. Beyond this it may be compressed to any extent, provided it be sufficiently plastic, by enlarging its base and shortening its height till it becomes a perfectly flat plate. With 12 tons its elasticity is much impaired, and it takes a considerable permanent set, which increases as the square of the load, and in most cases, where these effects are important, it is desirable, if not absolutely necessary, to keep within the limits of its elasticity.

We have already seen that both the top and the bottom of a ship have to resist a force of compression analogous to that sustained by columns, and that being the case it is desirable that we should become acquainted with the resistances of wrought-iron of different forms in that direction. It is also necessary to ascertain the laws by which these resistances are regulated in the relative positions of the upper deck and the lower hull of a ship. Effectively to resist these forces, it is obvious that the covering plates below and the stringer plates above require to be stiffened, or, in other words, to convert them into a series of horizontal pillars, calculated to offer an equally powerful resistance to compression as they do to tension. It was for that object that the late Professor Hodgkinson undertook—in conjunction with the writer, when engaged in the construction of the Britannia and Conway bridges—a laborious series of experiments on the compression of wrought-iron plates and tubes which form the top of these immense structures. These experiments apply with equal force to the construction of iron ships as they do to tubular bridges, and we may therefore find it serviceable to offer a few remarks upon them.

In the earlier experiments it was found that round, square, and rectangular tubes, of a given length, presented nearly double the resisting powers when the same weight of material was applied in the form of a tube or cell than it did in the form of a solid plate. These facts were subsequently confirmed by Professor Hodgkinson's experiments, of which the following table is an abstract. (See Table, page 28.)

A plate employed as a pillar resists flexure in a much higher ratio than in the simple proportion of its thickness, such stiffness or strength being analogous to the transverse stiffness of a beam; hence, as in the beam, it will also be highly advantageous to distribute any given material in a pillar, in such a manner as to ensure the greatest possible depth in the direction in which it is liable to bend. Mr. Hodgkinson states that if the pillars are short as compared with their diameter, such precautions are unnecessary, the cubic inch of wrought iron cannot be put in better form, but if it were rolled into a very long and very thin plate, one inch broad, and placed on edge, the smallest force would bend it. If we shorten this thin plate by increasing its thickness, but maintaining the same height of one inch, we shall increase its resistance to flexure in proportion directly to the cube of the thickness, and in proportion inversely to the length, since the length will diminish in the same proportion as the thickness increases, therefore the strength will increase directly as the square of the increasing thickness, or inversely as the square of the decreasing length, until the plate arrives at such a thickness that it will fail partly by crushing. This law will now begin to vary as we go on increasing the thickness at the expense of the length; and ultimately, as we approach the cube itself again, the strength, instead of varying as the square of the increasing thickness, will cease to vary at all with the thickness; its strength will, therefore, have varied during these changes, as every power of the thickness between 0 and the square of the thickness, while the resistance itself would be represented progressively by every quantity between 16 tons and 0, the quantity of material or section and height having remained constant, so that n-square inches of sectional area on the top of a tube may resist any compression between 0 and $n \times 16$ tons, according to the form in which it is applied.

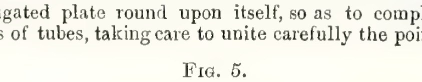
We should thus use the thickest plates we can get for the top of a ship or a tube, until their thickness was such that any variation in the thickness causes no corresponding variation in their resistance to compression; beyond this we get

Resistance of Rectangular Tubes, all Ten Feet Long, to a Force of Compression in the direction of their Length.

External dimensions of tube.	Thickness of plates.	Weight with which buckling or perceptible undulation was observed.	Weight of greatest resistance.	Form of section of tube.	Area of section of tube.	Weight per square inch of greatest resistance.
inches.	inches.	lbs.	lbs.		inches.	tons.
4·1 × 4·1	·03	...	5,534		·5040	4·9020
4·1 × 4·1	·06	...	19,646		1·0200	8·5986
4·25 × 4 25	·083	29,290	37,354		1·4840	11·2370
4·25 × 4·25	·134	46,314	51,690		2·3947	9·6360
8·175 × 4·1	·061	13,209	23,289		1·532	6·786
8·5 × 4·75	·264	...	197,163		7·326	12·015
8·4 × 4·25	·26 & ·126	99,916 (?)	206,571 = 92·2 tons.		6·89 (nearly)	13·3845
8·1 × 4·1	·059	37,401	43,673		1·885	9·877
$8\frac{1}{2}$ × $4\frac{3}{4}$	$\frac{1}{4}$ (nearly)	...	...		8·3466	Not crushed with 11·12 tons
8·1 × 8·1	·06 (nearly)	15,897	27,545		2·070	5·926
8·37 × 8·37	·139	82,475	100,395		4·9262	9·098
8·5 × 8·375	·2191	...	198,955		7·7367	11·48
8·5 × 8·4	·245 & ·238	...	...		8·4665	Not crushed with 11·05 tons
8·1 × 8·1	·0637	56,630	70,070		3·551	8·809
8·1 × 8·1	·0637	46,635	82,027		3·551	10·312

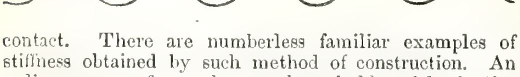
no further advantage. If, however, we are compelled to use thin plates, we should arrange them so as to ensure depth to resist buckling. If one cubic inch, when rolled out into a long strip, so as to fail by flexure, were, for instance, formed into corrugations, it would in this form support considerably more than in the form of a straight plate,

Fig. 4.



for instead of being a mere line in section, with no depth, it would now possess a depth equal to the versed sine of the corrugations, or equal to the distance between each convexity; and in this corrugated form we should attain the maximum resistance to pressure, viz., 16 tons, with our plates much thinner than when used straight. The depth would be still further increased if we folded our corrugated plate round upon itself, so as to complete a series of tubes, taking care to unite carefully the points of

Fig. 5.



contact. There are numberless familiar examples of stiffness obtained by such method of construction. An ordinary paper fan, and many household articles in tin, though constructed of thin and pliable material, are extremely strong and rigid from the depth acquired by the bending of the material. The domestic tea-board and dust-shovel are striking examples. It thus becomes a question, with a given section of material of given thickness, how to construct the strongest form of pillar or a series of pillars to resist crushing, and how near we can with this form approach to the limit of 16 tons per square inch.

Since a flat plate, for the reasons explained, will bend sooner than a curved plate, it would be concluded, naturally, that a round tube, of moderate dimensions and of given thickness and section, would be a stronger form than the same plate in a rectangular form, in which the resistance to crippling must depend solely on the four angles; and since the rigidity afforded by the angles is extended throughout the four sides of a rectangular tube, in some manner proportionate to the distance from the angles, it would be concluded that a square tube would be stronger than a rectangular tube constructed with the same plate, inasmuch as the central portions of the longer sides of the rectangle will be less maintained in form on account of their greater distance from the angles; similarly increased strength might be expected from this form These assumptions were all submitted to experiment and confirmed.

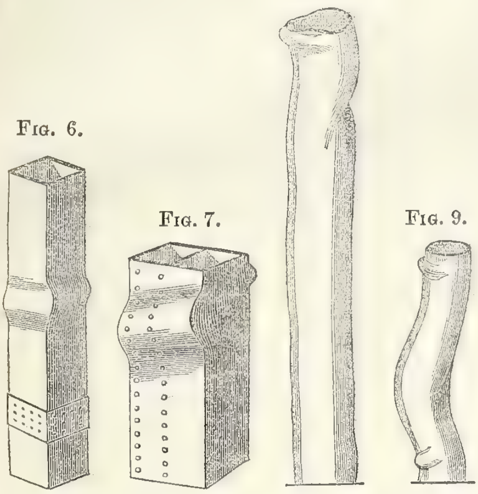
For this purpose a number of tubes or cells of wrought-iron were constructed, all ten feet long, and either four or eight inches square, or of rectangular form about four by eight inches; their ends were perfectly flat, and they were compressed, by the intervention of a lever, between two parallel discs of steel, with arrangements for maintaining the pressure perfectly vertical, the cells being supported laterally. The direct object was to ascertain the value of each particular form of cell, and to ascertain the resistance per square inch of section in each case. The lateral dimensions of these cells are so large, that with a length of ten feet the pillars were not destroyed by flexure as in a long pillar, but by absolute buckling or crushing; the strongest possible form should, therefore, give about 16 tons per square inch of section.

Similar experiments were then made with circular cells, under precisely similar circumstances for comparison. The cylinders varying from $1\frac{1}{2}$in. to 6in. in diameter; the diameter being so small in some cases as compared with the length, some of these pillars failed by

flexure, and followed the laws of long pillars, the resistance increasing nearly inversely as the square of the length; but where the diameter was six inches, the length being ten feet, flexure could not take place, and the cells failed by buckling or crushing, as in all the rectangular pillars, and in such pillars the strength is independent of the length.

To show how the failure in the rectangular and cylindrical tubes took place, the annexed drawings, as represented by Figs 6, 7, 8, and 9, may be useful.

FIG. 6. FIG. 7. FIG. 8. FIG. 9.



From the foregoing researches it will be observed, that in order to attain the maximum powers of resistance to compression in the use of iron plates in construction, that the square box with thin plates next to the plate itself is the weakest experimented upon; the next in the order of strength is the rectangular form with a division across the centre as at *a*, $\boxed{a}\boxed{}$ but the best distribution of the material is in the cylindrical form. This latter cannot, however, be accomplished conveniently in ship building, but the rectangular or cellular construction is applicable in all cases where resistance to compression as well as tension is required in the hull and upper decks of vessels.

LASTLY, ON THE DISTRIBUTION, STRENGTH, AND VALUE OF WROUGHT-IRON PLATES AND FRAMES AS APPLIED TO SHIPS AND OTHER VESSELS.—In this department of inquiry, we have not only to consider the nature of the strains to which the sides and other parts of a vessel are subjected, but we have to determine the distribution of the material in the different parts of the vessel, so as to establish as nearly as possible perfect uniformity of strength. What we mean by uniformity is, that the resistances in any one part of the vessel should be proportioned to the strains on any other part, and that no waste of material should take place beyond what is necessary to maintain the balance of the opposing forces of strain and resistance. In our endeavour to determine the superior value of iron as a material of which vessels should be constructed, we have not entered into the question of distribution. This is, however, one of the most important elements of construction, and in order to approximate as closely as possible to uniformity of strength, we have to apply the material in such forms and positions as will effectually resist all the various strains to which the vessel is subjected.

It will be observed, that in the preceding investigation we have invariably viewed the question of vessels as they are now built, being subject to much severer strains than formerly when built of wood. The present class of steamers are nearly double the length that they were formerly as sailing vessels; and the depths are much less in proportion, so as to render their powers of resistance to the action of the sea less than one-half that which would have been the case had the form of construction been upon the old principle. This being the case, a series of strains of double intensity are brought into existence, and these have to be provided against if we are to have safe vessels on the new principle of construction.

All these changes are elements of weakness unless met by an equable distribution of the material, and it is on this principle that we have treated the new build of vessels as hollow girders. Let us, for example, take a first-rate ship of war as built seventy years ago, such, for instance, as the *Victory*, and we have:—

	feet.	in.
For the length between the perpendiculars...	260	0
Breadth of beam	60	1
Depth	53	10

This according to formula $W = \frac{adc}{l}$ would—if built of iron and duly proportioned with sectional areas of 800 square inches, and if suspended on two points, stem and stern, sustain a load in the middle of 9,785 tons, or 19,570 tons if equally distributed.

Taking the same sectional area, and applying it to a vessel similar to the *Warrior*, and we have, with the same areas and the same constant 60, the decks being duly proportioned to the bottom,

	feet.	in.
For the length	380	0
Breadth	58	4
Depth	42	0

Hence $W = \frac{800 \times 42 \times 60}{380} = 5{,}305$ tons as the breaking weight in the middle, or 10,610 tons equally distributed, which is little more than half the strength of the former. From these facts it will be seen that we require an increased sectional area of 675 square inches in addition to balance the resisting forces of the two ships, which evidently shows that, increasing the length and diminishing the depth, the present build of vessels, when constructed of the same material, requires an increase of strength in the ratio of 1475 : 800 or as 1 : ·542. But this is not all, as we find from experiments on the effect produced on wrought-iron when subjected to alternate changes of load, that to build a durable vessel we should have to calculate the sections of the hull and upper deck, and to render it endurable under the varied strains to which it is subjected these should not, on the sectional area, exceed five tons per square inch.

A vessel thus constructed would, in our opinion, be perfectly safe under every condition when exposed to the action of the sea, but, if stranded upon a rock or shelving beach with coal and cargo on board, she would be severely tried by the force of impact when continuously rising and falling, and subjected to the influence of a tempestuous sea. But even in this precarious position it is very questionable whether or not she would go to pieces. On the contrary, we are of opinion, if constructed with water-tight bulkheads, strong longitudinal keelsons, and double bottoms, that in nine cases out of ten she would hold together, and save the lives of all on board.

In the distribution of the material there is another consideration of great importance, and that is, that in all bodies in the form of beams, whether hollow or solid (they follow the same law as regards a transverse strain), the strains are always greatest in the middle, and progressively diminish to the points of support at either end. These facts are self-evident, and show in the case of an iron ship that the same thickness of plates is not required when working from the centre at midships to the stem and stern. In fact, they should taper and be reduced in thickness in the

ratio of their distances from the centre till they reach the extremes at each end. Theoretically this is true, but in practice we have to consider how much the thickness can be reduced without danger to the structure, and in these we may here observe that the reduction should not exceed one-third between the centre and the two extremes. Or, in other words, if we assume the strakes or sheathing plates of the bottom and round the bilge to the height of the interior floor, or one-fifth of the depth, to be $\frac{7}{8}$th of an inch thick, it then follows that their thickness may be safely and progressively reduced to $\frac{5}{8}$ths thick towards the bow and stern. The same reduction to $\frac{5}{8}$ths thick may be made from that point, one-fifth of the depth, to the neutral axis of transverse strains, or about half-way up the ship's side, when they should again increase to $\frac{7}{8}$ths thick on the top strakes at the deck, on each side, where they have to perform the office of stringers under the action of the two forces of tension and compression.

From these remarks it is obvious that a careful distribution of the material is a desideratum of considerable importance in shipbuilding, and although it may be necessary in some constructions to make deviations, it is nevertheless essential that the law of strains should be carefully observed and weak parts effectively guarded against.

It will not be necessary in this communication to give drawings in illustration of these statements, as from other data the question may be rendered sufficiently explicit to enable the iron shipbuilder to proportion the parts in the ratio of the strains, and to afford to the ship, as a whole, ample powers of resistance to the forces by which she may be assailed; care however being taken to provide for wear and tear, oxidation, and all those other influences which tend to weaken the ship.

I would have entered more on this question, but I have already exceeded the limits of an ordinary paper, and must reserve for some future occasion the further development of a subject of such deep interest in connection with naval construction. I may, however, state in conclusion, that the iron navy of this country is destined to take the place of the "Hearts of Oak," and become—as many now living may hope to see it—the dread of our enemies, the bulwark of commerce, and the harbinger of peace.

DISCUSSION.

Capt. Henderson said—As an old sailor he wished to offer some observations on the construction of ships, but especially of light-draft steamers for India, in which he had had some twenty years' experience, and gained much information from Mr. Fairbairn. With reference to the diagram on the wall of a box-girder or deck-stringer, by which Mr. Fairbairn strengthens the upper decks of ships, he (Mr. Henderson) stated that he had practically adopted this system in river steamers of the Assam and native types, the bottom forming the bow, with seven keelsons, on the bow-and-string principle of construction. The Government sloop steamer, built for the Indies, was on the reverse, *i. e.*, the bottom formed the string, and the arched girder the bow above; and on being tried on the Thames in 1861, with full power of engine, the bottom bent downwards. The arched girder was strengthened before shipment to India. Similar trials on the Thames of the *Assam Nautilus*, also built by himself (Capt. Henderson), proved her speed and steering power; and her strength had been tested by grounding on the banks of the Thames, and lying across dock gates, with 40 tons on board.

Mr. John Hawkshaw remarked that little room was left for observation on the paper, because it dealt so largely with the elementary principles of construction which were generally known and acknowledged. He should, perhaps, best show the extent to which he agreed with his friend, Mr. Fairbairn, by mentioning the principal point on which he differed from him. The paper advocated what he would call the old-fashioned principle of putting together iron plates by punching the rivet holes, as better than that which he believed he (Mr. Hawkshaw) had adopted, perhaps more extensively than any other engineer, viz., by drilling. He differed entirely from the views laid down by Mr. Fairbairn in this paper. He (Mr. Hawkshaw) had used the method, which his friend Mr. Fairbairn must permit him to call the sledge hammer principle, for many years, and he had come to the conclusion that this punching principle, whether in shipbuilding or bridge-building, or in any other of those different constructions to which iron was now applied, was very faulty. He (Mr. Hawkshaw) had for some years past adopted the principle of drilling the plates, and he had no hesitation in saying, from his experience, it was greatly superior to the work which was produced by punching. He had no hesitation in saying that if the Britannia-bridge, instead of being put together by punched plates, had been put together by drilled plates, there would have been a better result by 20 or 25 per cent. There was considerable difficulty in the first instance, when he required manufacturers to drill instead of punch, viz., the increased cost which the manufacturers thought would be entailed by this plan, but such was not proved to be the case. Gentlemen who had constructed iron work for him, and who had adopted the principle of drilling instead of punching, had stated publicly, and he (Mr. Hawkshaw) was therefore justified in asserting, that having once gone to the expense of providing drilling machinery, it was cheaper to drill than to punch. He had had machinery constructed which would drill from 30 to 50 and even 80 holes at once, and the work obtained by that method was very superior to that on the old plan. A simple experiment would show this. Take a number of plates that had been riveted together, having been previously drilled, and saw them through the line of the rivets, and do the same with a similar number of plates riveted after being punched (and he had tried it himself), and it would be found that in the one case the line of demarcation between the rivet and the plates could scarcely be traced, while in the other numerous interstices not filled up between the rivet and the plates were frequent. If they had merely to rivet two plates together by punching, no doubt by adopting the principle of compression, which he agreed with Mr. Fairbairn was better than the hammer, these interstices might be filled up; but when a large number, say ten plates, had to be put together, there the punching system failed, whilst with the drilling system the ten plates could be put together with the same perfection as two. As that was the only point on which he differed from the views expressed in the paper, he might be excused calling attention to it. With regard to the paper generally, it laid down a great number of principles which were universally acknowledged, but it did not, as it appeared to him, touch that very difficult question as to what was to be the mode of construction for iron ships of war. He had himself, as far as he had had time and opportunity, given considerable thought to that question; and he was free to confess that the more he thought about it the more he found it surrounded with difficulties. He, therefore, could not agree with those gentlemen who thought that by this time somebody or other ought to have determined what was the best form of construction for a ship of war. Before they determined that question, they must settle previously which of two principles was to be adopted, viz., whether the armour of a ship was to form part of and conduce to the strength of the ship, or whether the armour of a ship should be treated as something extraneous to the ship, to be placed upon it or hung about it, to be donned or doffed as occasion required. Until these questions were answered he did not see how they were to arrive at the proper form of construction for ships of war. So far as he had had opportunity of judging—and he had seen *La Gloire*, as well as the *Warrior* and other specimens of war ships, and the various targets that had been experimented upon at Shoeburyness—he thought

there was a confusion of ideas as to what was to be aimed at. It did not appear to be settled whether the armour should form part of the ship, and therefore add to its strength, or whether it should be something merely to defend the ship itself. This must, however, be settled before ships could be built on an intelligible principle. He gave this opinion deferentially, because it was a very difficult subject, and possibly never would be solved without the terrible experiment of a great war. So far as he had been able to come to a conclusion on the subject, he did not see why the armour of a ship should not be made conducive to its strength. He was honoured by the committee appointed to consider that subject by being requested to construct what was called a target. It was not in fact a mere target he had constructed, but a combination of iron plates, to illustrate his own views of war-ship construction. He stated distinctly, in writing to the committee, that it was not put forward simply as a target, because if they wanted a target, a thing merely to resist shot, it was the simplest of all things to make. All they had to do was to make something as like an anvil as they possibly could, a large lump of iron of the best texture. This would doubtless resist shot. But the problem they had to solve was how to introduce this enormous mass of iron into the fabric of the ship, and whether it could not be conducive to the strength of the structure. This was not easy to do. The question, however, must be solved before they could set about building a ship of war.

Mr. John Grantham would take the liberty of intervening between his two friends, Mr. Fairbairn and Mr. Hawkshaw, on the question of riveting, a subject to which he had given great attention, and on which he had lately read a paper before the Institute of Naval Architects. He did not wholly agree with Mr. Hawkshaw on all his points. He believed that in bridge-building and all straight structures it was not difficult to drill the holes successfully, and much better than if they were punched; but the paper dealt principally with ship-building, and there a different condition of things arose. They had scarcely any straight plates in a ship, but they were for the most part of a curved form. The plates had to be applied singly, one after another, under difficult circumstances, and hence drilling could not be readily performed with success, and he considered it objectionable. In putting together two plates no advantage could be claimed for drilling, for when the two plates were put together, in drilling a burr formed, and the oil and dust from the outer plate fell in between the two plates; that accumulation and the burr had to be removed, and for this purpose the plates must be separated; and he could therefore say, as far as his own experience went, that Mr. Fairbairn's remarks as applied to ship-building were correct; but with regard to straight girders, or bridge work, with which Mr. Hawkshaw had been principally engaged, drilling was by far the best process with a number of plates. There was no question that the holes could, by drilling, be made more accurate than by separate punching, He had hoped that the paper would have dealt at greater length with some of the points of importance occupying public attention, and that it would have entered more largely on the question of the construction of ships of war. He thought the paper had not gone sufficiently into that subject. The great question of the day to be determined was, were our ships for the Royal Navy to continue to be built of wood, or were they to be built of iron? In the merchant navy this question had long been settled. It had long been settled that a ship was a girder in principle, and the nearer they approached to it the better. It had long since been settled that a ship must be strongest in the centre and lightest in the ends, but they had not yet settled whether a ship of war should be built of iron or wood. Some practical men had gone halfway in this matter, by introducing iron in one part and wood in the other. In his judgment that was an unfortunate combination. If iron was good, let it be iron; if wood was good, let it be wood—but do not combine the two together in the unfortunate way in which he thought it had lately been done. The great difficulty with regard to iron ships had not arisen upon any difference of opinion as to strength—that had been settled thirty years ago. The durability of an iron ship had also been long since settled. The commercial advantages of iron in ship-building had been long since acknowledged by the universal testimony of the mercantile community; but there was one question which was not yet settled, and that was the great question of fouling. The whole navy of Great Britain at the present day he believed would have been built of iron if the difficult subject of fouling had been got over. That was the real mischief now hanging over iron ships. Referring to another part of the subject, whether the iron plating was to be made part of the strength of the ship or not, they must determine whether the rest of the structure was to be of wood or of iron? If they had wood, all they could do was to hang the plates on the sides as a mere protection. If they made the rest of the structure of iron, then came the question whether the armour plating might not be made part of the strength of the ship? Why should they not make effective use of this ponderous protecting mass of iron in giving strength to the ship. Why should it be thrown away? Why should not the whole ship be built of iron? Were they still to adhere to that which the mercantile community had long condemned, and still cling to wood in the construction of the hulls of the ships of war? More especially, considering that all war ships were built for steam engines, for which a wooden structure was unfitted. Then came the question of fouling. He had been for 40 years connected with shipbuilding, and for 30 years had given his attention to the subject of fouling of ships, and he ventured to assert that, in spite of all the inventions and suggestions which had been brought before the public, they were no forwarder at this day than they were 25 years ago. He would call attention, however, to the fact that there were ships built half of iron and half of wood, but not in a manner adapted for some of our vessels of war. The ribs and many other parts were of iron; but the ship was afterwards covered with wood. Those ships had been found the best for tropical climates as regarded the fouling of the bottoms. They possessed many of the advantages of iron ships, and got rid of the evil of fouling. Ships of this class had been found exceedingly serviceable. He, however, would suggest an additioual step in this direction, and that was to build the whole ship of iron, and afterwards sheath her with wood, and copper her under the water. They had proofs that this system was excellent; it prevented fouling, and secured all the practical advantages of an iron ship. He believed if this had been done years ago there would not have been a single wooden ship in the navy, and the whole contest would have been at an end.

Mr. Rochussen said, as he was connected with several continental iron and steel manufacturers, he might be allowed to say a few words on the strength of iron, the use of which, as a material for ship-building, together with the employment of steam as a propelling power, was largely extending, not only in this country, but also in France and America. The average tensile strength of the ordinary iron used for ship-building was 32½ tons in the line of the fibre, and 31½ tons across the fibre. He had with him the details of experiments made by Mr. Fairbairn, which corroborated those figures. He thought that steel might with advantage be introduced into plates for ships; and it was worthy of consideration how far this lighter material might be beneficially employed. The steel might be rolled. It was simply a question of power. If, by so doing, 400 or 600 tons weight could be saved in the plating of a ship like the *Warrior*, it would afford great facilities for carrying a heavier armament.

Captain Selwyn, R.N., would say a few words on the question of strains to which ships were subject at sea. The strains were not as pointed out by the author of the paper

though he (Capt. Selwyn) was aware that such were in accordance with the views generally held, which supposed a ship being possibly suspended between the crests of two waves. Those who advanced that idea seemed to forget that which was sufficiently patent to all seamen, viz., that a ship in such a condition immediately sank in the water to a medium line of flotation. There were only two circumstances under which the waves could so operate: one was when from a gale or swell at the stern the waves came in that direction, and the other was when a vessel was driven by a gale against a head wind. Every good seaman knew it was madness to drive a vessel ahead against a heavy gale of wind, for if they did so invariably the bows shot out 50 or 60 feet unsupported in the air. Under those circumstances strains were brought on the vessel such as nothing ever built by human hands could hope to stand against. A good seaman would either lie-to or make only moderate speed. It was true in modern days the outside pressure for quick passages sometimes led seamen to act against their better judgment, but they knew they did so at the risk of the vessel breaking up. He had spoken of the sea coming up by the stern, and under such conditions no such strain as had been described need be feared. The vessel, it must be remembered, was going ahead at a given rate, and the wave and undulation—for he made a distinction between the two—the wave rose and fell, but its particles were not propagated forward as fast as the undulation. Those waves coming on the stern found the vessel progressing in their own direction, and they then only gently lifted the stern and passed under the ship, not causing any great strain, and seldom pooping the vessel unless some false manœuvre had been performed. With regard to the question of thickness of plates for ships, he begged Mr. Fairbairn to consider whether or not he could safely recommend increased thickness in the midships, and decreased thickness at the ends, considering that it was not so much the effect of the strains that was to be feared as the results of concussion when a vessel grounded on a bank and then lifted with the sea. After the battle which had been so severely fought between wood and iron, compromise was a very agreeable thing to hear of, but he was afraid that Mr. Grantham had not sufficiently considered the effect of shells in his recommendation of a sheathing of wood, which he was sure would be stripped off in ten minutes after the vessel had been in action, or would be set on fire by shells; and even if the wood were rendered partially incombustible, as no doubt it might be done, the smoke from the smouldering wood would be sufficient to render the vessel untenable.

Mr. Grantham said the wood sheathing would only reach to the edge of the armour plates, several feet below the surface of the water.

Captain Selwyn added that trial had been made of that plan, and it did not answer when armour plates were concerned. He had read a paper before the Institute of Naval Architects on the galvanic action of the bottoms of ships. It was proved that galvanic action could not be interrupted; as it went on between the iron and copper and salt water, either by strips of intervening material or otherwise, and in spite of every device hitherto thought of. It did go on, because though there might not be metallic conduction, yet there was conduction through the water which was sufficient to set up and carry on galvanic action. The effect of this was accumulated at the point of contact with the armour plates. That action was not less to be feared in the lighter construction for mercantile purposes, and the rivets constantly dropped out, as in the case of the *Harbinger*. In some instances the galvanic action had been stopped by protecting the bottom with asphalte, and in one case by a coating of brickwork covered with asphalte. With respect to the bricks, they contributed nothing but an objectionable weight, and he thought a better material than asphalte might be employed for preventing the salt water from acting as a medium of setting up galvanic action. These matters were so important in the advanced state of shipbuilding that calling attention to them was not out of place.

The Duke of Somerset, in proposing a vote of thanks to Mr. Fairbairn, said he was sure those who had heard the paper, and the discussion that had followed on it, would admit that very many important questions had been raised. He further thought it would be admitted that the Admiralty had at least been placed in some difficulty, when called upon, at short notice, to provide the best ships of war. They had been told that evening that it was very difficult to say what was the best possible ship of war, by persons who had been inquiring into the subject for many years. They were told that the Admiralty ought to provide ships of the best iron, and projectiles of the best steel, and yet, when they came to inquire as to what was the best iron and the best steel, there was no conclusive knowledge to be obtained. Dr. Percy, in the preface to his book on Metallurgy, stated that as regarded the chemical nature of iron, our knowledge was very imperfect; and as to steel, still more so. Then they came to the mechanical tests: and the question then arose how far did the tests injure the iron? That question was very important, and one which he did not think had been clearly settled. He wanted to know how far they could proceed in testing without injury. It was proposed in the paper that iron vessels should be tested. Would they for that purpose place the two ends of a vessel in the position represented in the drawing, in order to see whether or not she would break; or would they test the plates? Would such tests, if the vessel withstood them, leave the ship or plates uninjured? and could they be sure that no injury had taken place? With regard to the testing of chain cables also, the same question arose—were they quite sure, in the testing of chains, how far they might test them with safety? In regard to the proving of cannon, again the same question arose—their testing might injure the metal. As to steel projectiles, how were they to test them? Were they to fire against iron plates every time? Were they to break a number of plates in order to break the projectiles? Then as to the construction of the ship of war. They had been told that the Admiralty were advocating a wrong principle, and that they ought to make up their minds and build entirely with either all iron or all wood; and another gentleman had told them he had successfully built iron ships, and covered with wood. In attending the meeting that evening, he was in hopes of learning that some of these conflicting questions were about to be solved, and that he should have gone to the Admiralty in the morning, and informed his colleagues that the whole question had been set at rest. But he was still left in difficulty. They were told that iron was the best material for resistance, and that they ought not to combine iron and wood together. That had been the opinion of the Admiralty, and it was the opinion also of Mr. Fairbairn. They tried experiments at Shoeburyness, but Mr. Fairbairn had told them they must put a certain quantity of wood behind the iron, in order to obtain an effective resistance to shot. This evening, however, some gentlemen had told them not to use any wood at all. This showed that the subject was still surrounded by numerous difficulties. He would say he was delighted to have heard this discussion, and he hoped they should at some future time have another paper devoted to the consideration of some one or two of the points on which they desired to be enlightened. Instead of entering into general questions let them take up one great question and see if they could arrive at satisfactory results upon it. In the meantime he had great pleasure in proposing a vote of thanks to Mr. Fairbairn for his very able paper.

The vote of thanks having been passed,

Mr. Fairbairn said the paper was not intended to be limited to the question of armour plate and ships of war,

but it applied also to vessels for commercial purposes. The main object was to show how, both in the navy and mercantile marine, the material could be best distributed in order to obtain strength in the ship. With regard to riveting, he was quite aware there was difference of opinion; but his own feeling was, where riveting was well executed, they could not have a better test of the quality of plates than by punching, and, where the holes were well punched, he preferred them to the drill, as he found that in drilling the holes were not always exactly coincident. Then as regards ships of war, he hoped on a future occasion to bring forward another paper on this subject, which he trusted would lead to a discussion that would realise to some extent what the Chairman had suggested as important, viz., something like certain information for the Admiralty to rely upon in the construction of ships. He should do his best to accomplish that object, and from the experience he had had he might state that he was satisfied iron was a better material than any other for building ships either for war or mercantile purposes. Under all these circumstances, he hoped the Admiralty would persevere in what they were now doing in the construction of iron ships. On the question of armour plates, he would say, if they were to have 300 or 400 pounder guns it was a question with him whether it would not be better to be without armour plates altogether, and let the shots go right through, because they were limited to a certain thickness and weight of plates; and if they were to cover vessels from stem to stern, and five feet below the water line, they would not be able to carry plates that would resist those large guns. If that description of artillery was used, his opinion was they would have a more secure and better navy without the iron plates than with them.

The Secretary called attention to some photographic copies of engineers' drawings, lent by Mr. W. Willis, of Bath-street, Birmingham. By means of a photographic process, the details of which are not yet published, copies of drawings can be made rapidly and cheaply of the same size as the original. The original drawing is in no way injured by the process, and the copy is produced by simple superposition over the chemically-prepared paper, and is a positive copy direct without the intervention of a negative.

The Secretary also called attention to a model of a tilt hammer, moved by means of a knee joint, driven by direct action of a steam piston.

DUBLIN INTERNATIONAL EXHIBITION, 1865.

The Committee of the International Exhibition for 1865, have great gratification in publishing the following correspondence, conveying Her Majesty the Queen's gracious assurance of support to the undertaking:—

Dublin Castle, Nov. 19th, 1864.

MY DEAR DUKE,—After the interview I had the honour of holding with the deputation representing the Committee of the Dublin International Exhibition for 1865, I wrote to Colonel the Hon. Sir Charles Phipps, submitting the request that her Majesty would be graciously pleased to allow the Exhibition to be placed under the Royal patronage, and your Grace will be gratified to learn, from the enclosed correspondence, that this request has been most promptly complied with.—I am, yours very faithfully, (Signed), ROBERT PEEL.

His Grace the Duke of Leinster.

Dublin Castle, Nov. 15th, 1864.

MY DEAR SIR CHARLES,—A deputation comprising the Duke of Leinster, Sir George Hodson, Bart., Sir R. Kane, Mr. Dargan, and several other members of the Committee of the Dublin International Exhibition for 1865, have just had an interview with me for the purpose of conveying the expression of their hope, through their Chairman, the Duke of Leinster, that her Majesty would be graciously pleased to allow the Exhibition to be placed under her Royal patronage.

From the enclosed prospectus it will be perceived that the enterprise is no longer of a purely speculative character, as it promised to be if it continued in the hands of the directors of the Winter Garden Company.

That Company has now nothing to do, as the Duke assured me, with the undertaking, and indeed many of the names on the Exhibition Committee are a guarantee of the respectability and public spirit which has been elicited in support of the movement.

I hope it will not be considered that I have gone beyond my duty in venturing to request that you would take a fitting opportunity of submitting this request for the patronage of the Queen to the notice of her Majesty, and there can be no doubt her gracious compliance would not only be most valuable to the prospects of the Exhibition, but that it would have the effect of giving a salutary impetus to the spirit and loyalty of all who are interested in the welfare of this country.—I am, &c., &c.,
(Signed) ROBERT PEEL.

Col. the Hon. Sir C. B. Phipps.

Windsor Castle, Nov. 17th, 1864.

MY DEAR SIR ROBERT,—I have had the honour to lay before the Queen your letter of the 15th inst., and the objection, to which on a former occasion I alluded, having been removed, I have received the commands of her Majesty to say that she is happy to be able to accede to the request contained in your letter, and to sanction the announcement of the Dublin International Exhibition as under her Majesty's patronage.

The Queen wishes the promoters of this patriotic undertaking every success.—Sincerely yours,
(Signed) C. B. PHIPPS.

Right Hon. Sir R. Peel, Bart.

Fine Arts.

EXHIBITION OF INDUSTRIAL ART IN PARIS.—This exhibition, which is now open in the Palais de l'Industrie, in the Champs Elysées, and which will continue so until the end of the year, is got up by one of the societies formed to aid the progress of art as applied to industrial purposes, and embraces specimens of the ingenuity of the past as well as of the present time. There was some delay in completing the arrangements, but at the present moment, although the collection is not large, it presents considerable interest. It occupies the whole of the central portion of the building, which is laid out as a garden, and all the objects are seen to the greatest advantage. The principal objects are contained in three large square pavilions, which occupy the centre and two ends of the garden. That in the middle contains some remarkably fine specimens of galvano-plastic work from M. Oudry's works, at Auteuil, where the great fountains, candelabra, and other objects for the city of Paris, are submitted to the electro process, and of which we gave a report from personal inspection in the pages of the *Journal* some months since. The most conspicuous specimen in M. Oudry's collection, is a reproduction of an alto-relievo from the triumphal arch of Constantine; this specimen of galvano-plastic art is no less than twelve feet high and nearly nine feet wide, and weighs nearly four thousand pounds English. The mould was taken in gutta-percha, from a plaster cast. This noble work is surrounded by a fine collection of electro bronzes—statues, statuettes, busts, and ornamental works, iron castings covered with copper by M. Oudry's peculiar process, specimens of plate rolled after deposit, spikes and nails for ship-building covered with a thick coat of copper, and other similar objects; also a number of articles painted in imitation of bronze with M. Oudry's peculiar bronze pigments. A second pavilion contains a most remarkable collection of antique objects of art industry from the celebrated museum of M. Le Carpentier, whose antiquarian wealth approaches that of M. Sauvageot, whose collection is now in the museum of

the Louvre. The selection lent by M. Le Carpentier to the exhibition contains specimens of almost every kind, from the carved runic staff to the royal game of goose, which Louis XIV. played at when a child (this latter is, however, the only object not of importance in an artistic point of view). The articles are of all ages and countries, and include works of metal, wood, and ivory—jewellery, china, faïences, enamels, terra-cotta, and embroidery. The metal work and carvings are, perhaps, the most remarkable of all, but the whole collection is extremely choice; the case of French enamels is especially noticeable, and some of the small arms of the best Italian period are very beautiful. Amongst the iron work is a shuttle, pierced and engraved most admirably—the elegant instrument with which some aristocratic Ariadne of the fifteenth or sixteenth century made the mantle of her liege lord. The expenditure of so much art on such an object marks curiously the change that has come over the habits of civilised people. The collection of retrospective art includes contributions from other virtuosi, and also from dealers in antiquities. The third pavilion covers a selection of fine specimens of modern art, made by the society from amongst the objects sent for exhibition; and each visitor on entering receives a printed ticket, which entitles him to a chance in the lottery which is to take place at the conclusion. It is fair to mention here, seeing that the objects of the society are purely patriotic, that the price of admission is half a franc on ordinary days, one franc on Friday, and five sous on Sunday. The exhibition, happily, does not contain a mass of the common *articles de Paris*; almost every stand has something in the way of novelty or improvement to recommend it, at any rate the exceptions are the minority. The class of wares best represented, perhaps, are faïences; there are some very beautiful specimens of ornamental porcelain, but the fashion of the moment is for earthenware, and naturally, the manufacturers are making great efforts to rival the productions—now so well known here—of Minton and other English makers. French ornamental wares of this class are not remarkable for colour; in this they are far behind Staffordshire. But the Parisian and other potters are making great strides in the production of panels and other pieces of ware for decorative purposes. The greater portion of these are imitations of Della Robia or other ware, the best are produced after original designs in the flat, somewhat affected, but graceful manner of Hamon, who himself has not disdained to lend the aid of his pencil, as Flaxman did, in the potter's service. The introduction of figures and landscapes on faïence slabs, in carved frames, has recently, may be parenthetically observed, become quite the fashion in the houses of the rich in and near Paris; and, in some instances, similar ornaments have been introduced into halls and vestibules and exterior walls, and with charming effect. The number of exhibitors in this class is not great, and when we mention A. Jean, who has a house in London, Deck, A. Gouvrion; Masson, late Ollivier, established in 1742; Devers, an Italian; and Collinot and Co., all of or near Paris, we believe we have exhausted the list. (We may here note that there is not yet any catalogue of the exhibition.) Messrs. Collinot present a novelty in what is called *émaux cloissonnés*, and have covered their process by a patent; the designs, besides being slightly raised above the ground of the vase or other object, are marked by a very decided outline, hence the name selected for this new style of ornamentation. It is worthy of remark that the makers of porcelain and other fixtile ware have of late borrowed the very artistic habit of the Chinese, in mounting their best pieces on wooden stands carved in appropriate forms. It is marvellous how much more appearance of value a beautiful vase acquires by this treatment. Another sign of the time is to be seen in the iron works in this exhibition, which includes some very fair examples of pure hammered work as applied to the furniture of fire-places, lamps, and other domestic objects; some mere reproductions of the antique, others exhibiting truly artistic taste without conventionality. We can no more expect *repoussé* work to replace casting and other modern modes of ornamentation than we can look for the resuscitation of the post-chaise in competition with the railway, but the hammering of iron, or other metal, into graceful forms is so high a branch of industrial art that it is pleasing to find it not quite neglected—especially when we take into account its unrivalled effect. The exhibition is decked with some very fine specimens of tapestry from the Gobelins, Aubusson, and other looms, and in juxtaposition with these semi-artistic productions, are some very good specimens of the machine-made carpets and tissues of a company established at Meaux. Among the miscellaneous objects is a new kind of fuel, composed of tan and coal-dust, recommended for all kinds of fireplaces, but which seems to have slipped by accident into an exhibition of industrial art; a system of lighting establishments by means of petroleum oil forced through pipes of small diameter by means similar to those used in the moderator lamp; and a new bathing machine, or boat, which has quite charmed the Parisians. This last novelty consists of a very light frame or basket, rendered buoyant by means of cork or other floats, and propelled by a screw; the bather lies at full length, with his head on a pillow, and works the propeller by means of a winch; and, as the axis of the screw is jointed and provided with discs, against which he places the soles of his feet, he can guide his bark wherever fancy directs. Some of the *Baigneuses*, as these new toys are called, are floated by means of four or more silvery-looking swans, and have been dubbed Leda's cars. The *Baigneuse* promises to be a success, as it is already being made the butt of a good deal of light wit; the prospect of going to sea in a sieve is charming, says one writer.

Manufactures.

Paper Making Materials.—A society has been formed in France, having for its object the investigation and discovery of vegetable fibres to be used in lieu of rags for the manufacture of paper, and for the organization of mills which should furnish the pulp-stuff to the associated makers. The communications already made on this subject have been referred to the general committee of paper makers as matters for careful inquiry and further proceedings at future meetings. The esparto grass, of which some 40,000 tons were exported from abroad for paper making last year, has been found growing along the coast of Cumberland, and local paper makers are carting it to their mills in great quantities, at the merely nominal price of carriage, instead of having to pay five guineas per ton for Spanish.

China Grass.—The French manufacturers are experimenting largely upon the use of the nettle fibre known under the popular name of China grass. We have been favoured with a sample of fabric made with an equal mixture of 100 kilogrammes of Surat cotton and the same quantity of China grass at Rouen last month. The French papers are freely discussing the report of the Rouen Chamber of Commerce of the 18th ult. on the subject.

German Carpets.—Some of the largest carpet manufactories in Germany are established at Hanau, and the carpets made there are said to surpass those made in England, and have a high reputation even in Paris. One of the best known and most extensive carpet manufactories in that town is that belonging to Bernus Leister and Co., especially as regards the finer kinds, which are highly esteemed both for the fastness of the colours and the good taste of the designs. This establishment employs a steam-engine of 20 horse-power, about 150 men, and 100 women. The greater part of the carpets manufactured in Cassel are bought at the Leipsic fairs for the Danubian Principalities. The above-mentioned firm employs 60 or

70 looms for spinning yarns, and altogether about 350 workpeople. Thirty or forty workmen are now employed in carpet weaving in smaller establishments in the city of Cassel.

Colonies.

The Buller Coal-fields (New Zealand).—Steps are at length being taken by the Nelson Government, to open out these extensive coal fields. As it is impossible to raise the necessary capital to work the mines in a profitable manner in New Zealand, the authorities are about to send Mr. J. Burnett, who has had considerable experience in coal mining in England, to London, to form a company and raise the necessary capital; this gentleman will be furnished with plans, views, &c., of the district, and will also bring several tons of the coal with him. There can be no doubt as to the richness and extent of these mines.

Electric Telegraphs (New Zealand).—The general Government are about to lay down the electric telegraph from Auckland to Dunedin, a distance of about 1,000 miles; although possibly the native war may interfere for some time with its construction in the Northern Island, that portion running through the South Island from Nelson, *via* Picton, Christchurch, &c., to Dunedin, will, it is hoped, be in active operation within a few months, contracts for poles, &c., having been already accepted; whether the rocky deep bed of Cook's Straits will be suitable for a submarine cable remains to be tested by survey and experiment. The distance from land to land is short, being in one place less than 25 miles. It will doubtless be some time before this portion of the work will be undertaken. The Morse instrument will be used.

Publications Issued.

Barometrical Observations in the Antilles and Neighbouring Countries. By M. C. Sainte Claire Deville. —A remarkable *brochure* on diurnal and annual variation, geographical differences, and the relations between atmospheric pressure and the synodic revolutions of the moon.

Notes on a Little Known Function of the Pancreas—the Digestion of Azotized Food. By M. Corvisart, Physician in Ordinary to the Emperor. Paris. —This work contains the results of the observations of many members of the French faculty, as well as of the author, and has attracted great attention.

Notes.

Exhibition of Dead Poultry in Paris.—An exhibibition of fat poultry is to take place next month, in the Palais de l'Industrie. Intending exhibitors are to apply, before the 1st of December, to the Minister of Commerce. On the first day of the exhibition, the jury will award the prizes in the morning, and the public will be admitted in the afternoon; on the second day, there will be a public exhibition, ending with a sale by auction.

Free Public Laboratory.—The French Government has decided on opening a free laboratory for practical chemistry, the direction being placed in the hands of M. Fremy, Member of the Institute, and Professor. M. Ménier, a manufacturing chemist, who proposed to open a similar establishment, has given up the idea in favour of the government plan, and has contributed the sum of 10,000 francs in aid.

The Tragopan.—Among the birds just received at the Jardin d'Acclimatation in the Bois de Boulogne, are some tragopans, a kind of Chinese pheasant, sent by M. Dabry, French consul at Han-Keou. These birds are called Too-chew-kee by the Chinese, a name meaning:—"The bird that vomits flakes of silk." They are brought from the mountains of Sze-Chwen, and also from the Hoopay, Fokin, and Kwang-Tong districts, where they are much esteemed by the inhabitants, both for their plumage and the delicacy of their flesh. Viceroys and rich people always keep some in cages as curiosities. The size of the tragopan does not exceed that of a common hen. Its plumage displays the most varied and brilliant colours. The head is jet-black with a gold-yellow crest; the eyes are large and bordered with blue; the neck is sky-blue, the breast a fiery red; the back and abdomen speckled white on a red ground. During summer it displays the magnificence of its plumage by puffing itself up and strutting about with the pride of a peacock, every now and then uttering a horse caw; then all at once it thrusts out a tongue at least a foot long, of a beautiful blue speckled with fiery spots along the middle, at the same time two charming little blue horns make their appearance on its head. This delightful spectacle lasts about a quarter of an hour, after which the bird withdraws its tongue, lets down its horns, and subsides again into its sober toilette for common wear, uttering an odd sound, as if in mockery of the spectators. This bird, according to Chinese naturalists, is not only one of the wonders of nature on account of its plumage, but it also possesses the most important virtue in the eyes of the Chinese, viz., filial piety, for the young ones take care of their parents when age or illness renders it impossible for them to provide for their own nourishment. This affectionate care has procured this creature the name of Hiao-Ky, or "bird of filial piety." It is also called Py Choo-Ky, or "bird that avoids trees," because it haunts rocks rather than woods. Its flesh is excellent, and the Chinese say it has the property of making a man intelligent. The tragopan is of the pheasant family, and this is the first time it has been seen in France. There is every reason to hope that it will be acclimatised.

Correspondence.

Brokers and Middlemen.—Sir,—Some remarks made by the Vice-Chancellor Sir W. Page Wood, in moving the well-earned thanks of the meeting of the 16th inst. to the Chairman of the Council, for his able address on the opening of the session, deserves, I think, some special notice, as putting in a clear and even a new point of view the real position and duties of the Society of Arts. He said that "this Society filled, with respect to Arts, Manufactures, and Commerce, the position which was occupied in commerce by the 'broker' or 'agent.'" We have so much to learn in this life that it is always desirable, and saves valuable time, if we can thus detect analogies between any two branches of knowledge, or any two systems of organisation which reflect light the one upon the other. This is especially the case if, as in this instance, one branch of the illustration is well known, and does not require to be argued at any length. Many persons then present practically knew the value of the broker, who "ascertained and supplied the wants and needs of different classes of the community." A trader has, perhaps unexpectedly, to buy a particular article. He is a stranger to the market, and goes, therefore, to the broker to purchase. Another trader has the same kind of article to sell, and, going to the same broker, he, the broker, then becoming a "middle man," is thus a convenience to both parties, and a benefit to the community. There is something analogous to this process in the retail shop; the analogy holds yet stronger in the wholesale warehouse, which assembles, under one roof, the productions of various and distant manufactories. So, a Society of Art, of Manufacture, or of Commerce, having relation at once with the inventor and the machine

maker—with the workmen and the employer of workmen—with the actual labourer and the capitalist—with art and the admirers of art—become "middle men" in the noble trade of science, and "brokers" in the exchange and the pursuit of knowledge. I could pursue the analogy further, but, if there be any truth in the analogy, your readers will better pursue it for themselves; and I can only add that, with a Prince for their President, and the heir to the throne in the chair, on the one hand, and their intimate and extensive connection with inventors, designers, manufacturers, and workmen of all classes and ranks on the other hand, it will go hard if they do not conduct their business, as a Society of Arts, Manufactures, and Commerce, with some degree of credit to themselves and with no small benefit to the community at large.—I am, &c., John Dillon.

November 21, 1864.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...R. Geographical, 8½. 1. Viscount Milton and Dr. Cheadle, "Journey across the Rocky Mountains into British Columbia, by the Yellow Head Pass." 2. Mr. John Macdonald Stuart, "On his Last Journey of Exploration to Northern Australia, with an Account of the Country about to be Colonised on the Banks of the Adelaide River."
Actuaries, 7. Mr. W. M. Makeham, "Solutions of General Problems in Survivorships."

Tues. ...Civil Engineers, 8. Mr. E. H. Clark, "Description of the Great Grimsby (Royal) Docks, with a detailed account of the enclosed land, entrance locks, dock walls, &c."

Wed. ...Society of Arts, 8. Mr. Bridges Adams, "On the Mechanical Conditions of Railway Working to Prevent Destructive Wear and Risk."
Royal, 4. Annual Meeting.

Thurs...Antiquaries, 8.
Linnæan, 8. 1. Dr. Bastian, "On Nematode Worms." 2 Dr. Cobbold, "Brief Notice of Results obtained by Experiments with *Entozoa*." 3. Dr. Baird, "On Tubicolous Annelids, from the Collection in the British Museum."
Chemical, 8.

Fri.......Philological, 8.
Archæological Inst., 4.

Sat.......Artists and Amateurs, 7. Annual Meeting.

Patents.

From Commissioners of Patents Journal, November 18th.

Grants of Provisional Protection.

Aerated bread—2635—G. T. Bousfield.
Aeriform bodies, heating, cooling, &c.—2666—D. Laidlaw and J. Robertson.
Agricultural and traction engines, &c.—2662—J. Craven and S. Fox.
Animal charcoal, re-burning—2695—J. F. Brinjes.
Artificial stone—2664—E. J. W. Parnacott.
Axles—2698—W. E. Gedge.
Bolts or fastenings—2682—W. Clark.
Brackets—1975—E. and F. Crook.
Brushes—2671—J. and P. Goodall.
Buttons—2703—W. Aston.
Centrifugal pumps—2735—H. A. Gwynne.
Chimney pots for prevention of down draft—2775—J. Bell.
Cisterns, waste pipes of—2725—J. Cutler.
Clothing for horses, &c.—2705—R. Richardson.
Cotton-gins—2660—J. Shelmerdine.
Distilling—2749—F. H. Bickes.
Dyeing and printing, obtaining colouring matters for—2785—J. Dale, H. Caro, and C. A. Martins.
Electricity, application of as a motive power—2681—L. P. G. Bellet and C. M. P. De Rouvre.
Electric printing for telegraphic purposes—2687—J. H. Simpson.
Electric signals for gunnery practice—2423—F. N. Gisborne.
Fabrics and fibrous materials, drying, &c.—2685—J. L. Norton.
Filters—2757—J. Slack.
Fire-arms—2763—G. P. Harding and L. Thomas.
Fire-arms and projectiles—2669—J. P. Harriss.
Fire-arms, breech-loading—2741—J. Snider.
Fire-arms, breech-loading—2759—W. E. Newton and E. C. Shepard.
Fire-arms, breech-loading, and cartridges—2777—S. Rydbeck
Fire-places—2696—P. L. Charon.
Glue and size, manufacture of—2723—H. W. Spencer and J. E. Ball.
Grain, machinery for cleansing—2755—W. E. Gedge.
Gunpowder, manufacture of—2594—L. H. G. Ehrhardt.
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Iron and steel, manufacture of—2738—F. Yates.
Jacquard apparatus for weaving figured fabrics—2743—D. Ellis and M. Hillas.
Kneading, measuring, and discharging dough—2694—E. Edwards.
Lace-making machinery—2676—J. Hartshorn and J. Gadsby.
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Lamps, preventing extinction of—2700—P. A. Roger.
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Metallic substances, cutting and drilling—2715—C. W. Wardle and R. McIntyre.
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Overground telegraph wires, insulating—2536—L. J. Crossley.
Panels, &c., constructing—2680—A. H. A. Durant & W. H. P. Gore.
Paper cloth—2311—L. Cooke.
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Photographic process—2717—T. Fox.
Pianofortes, &c., stringing and tuning—2697—W. Moody.
Presses for expressing fluids—2692—J. M. Rowan.
Railway carriages, applying wheels and axles—2701—W. Rice.
Railway carriages, warming and cooling—2691—G. Davis.
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Railways, rails for the permanent way of—2677—H. A. and J. E. Jowett, and J. B. Muschamp.
Railway trains, signalling between passengers and guards on—2712—F. J. Scott.
Railway wheels and axles, combining—2708—J. Furnevall and G. Keighley.
Railways, mechanism for preventing accidents on—2753—G. Simpson.
Resins and hydrocarbons, manufacturing and refining—2497—J. I. Vaughan.
Sea-water, conveying to inland places—2783—J. Rae.
Sewing machines, arrangement of for use in shoemaking—2667—W. Jackson.
Sextants, &c.—2665—R. A. Brooman.
Ships' sails, reefing—2570—J. Hart.
Shovels and spades, affixing the handle to—2449—J. O. Communay.
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Steam-engines—2699—T. Ivory.
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Steel, casting—2714—E. L. S. Benzon.
Sugar manufacture, centrifugal apparatus used in—2678—A. and W. Smith.
Syphons—2686—G. H. Devereux.
Syrups, manufacture of—2646—P. Dutrulle.
Textile fabrics, treatment of—2773—J. H. Johnson.
Utensils (chamber), fitting and mounting—2689—B. Scalé.
Vessels and ships, protecting the bottoms of—2672—G. Ager.
Whip-holder—1846—J. C. White.
Window-blinds, regulating cords of—2765—R. Montague.
Woven fabrics, lustreing and drying—2739—T. N. Kirkham, V. F. Enson, and H. Brook.
Yarns, apparatus for wringing, &c.—2661—J. Stobo and W. Pollock.
Yarns or fabrics, sizing, dressing, &c.—2668—J. and H. Charlton, and J. O. Christian.

Invention with Complete Specification Filed.

Carriages, opening and closing the heads of—2819—C. Martin.

Patents Sealed.

1235. L. L. Sovereign.	1313. H. M. Harwood and G. Whitford.
1281. J. Edwards.	1386. W. Clark.
1284. W. G. Todman and J. H. Todman.	1714. J. W. Horsfall.
1285. C. P. Coles.	1842. D. Barker.
1296. B. Jones.	2118. J. Campbell.
1297. G. Moulton.	2222. J. Williams.
	2223. H. C. Baildon.

From Commissioners of Patents Journal, November 22nd.

Patents Sealed.

1306. G. Davies.	1399. J. Dodge.
1307. H. Redfern.	1427. J. T. Crick.
1310. J. H. Brown.	1569. J. Holt.
1311. C. Boutet.	1612. W. Clark.
1322. J. Hudson and C. Catlow.	1636. M. P. W. Boulton.
1341. G. Herbert & R. Stainbank.	1923. A. Smith.
1346. G. Davies.	2008. G. Haseltine.
1362. F. O. Ward.	2126. J. Lones.
1375. F. O. Ward.	2193. J. Fleming.
1377. J. J. McComb.	2254. A. Bertsch.
1380. F. Ashe.	2361. J. Mackay.

Patents on which the Stamp Duty of £50 has been Paid.

2914. F. Johnson.	2915. J. C. Croxford.
2896. R. A. Brooman.	2919. E. Peyton and W. F. Batho.
2903. T. Redwood.	

Patents on which the Stamp Duty of £100 has been paid.

2864. G. P. Wheeler.	2968. F. G. Grice.
950. W. Blinkhorn.	2927. J. M. A. E. Fabart.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, DECEMBER 2, 1864. [No. 628. Vol. XIII.

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Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

DEC. 7.—"On the Construction, Retardation, Safety, and Police of Railway Trains." By W. BRIDGES ADAMS, Esq.

DEC. 14.—"On the Recent Progress and Present State of Industry in Ireland; and the Dublin International Exhibition of 1865." By Sir ROBERT KANE, F.R.S. On this occasion Lord DUFFERIN will preside.

DEC. 21.—The Articles sent in Competition for the Art-Workmanship Prizes will be Exhibited, and a Report in connection therewith will be read.

CANTOR LECTURES.

There will be three Courses of "Cantor" Lectures on the following subjects during the ensuing Session:—

"On the Reproduction of Natural Forms by Art and Manufacture." By B. WATERHOUSE HAWKINS, Esq., F.G.S., F.L.S.

"On the Application of Geology to the Arts and Manufactures." By Professor D. T. ANSTED, M.A., F.R.S.

"On the Application of Chemistry to the Arts." By Dr. F. CRACE CALVERT, F.R.S.

The following is a syllabus of Mr. Hawkins's course, with the dates of delivery:—

DEC. 12TH.—LECTURE I.—INTRODUCTORY: — On the nature and probable influence of museums of natural history and art collections, and their effect on the public mind and taste. (Illustrated.)

DEC. 19.—LECTURE II.—Demonstrations of the unity of plan in the external forms of animals, the just appreciation of which facilitates the work of the artistic producer, and adds to the enjoyment of the intelligent possessor of works of art.

JAN. 16TH, 1865.—LECTURE III.—On the varieties of artistic treatment of the forms of animal and vegetable life—pictorial representation; conventional ornamental, allegorical, and symbolic combinations of animal forms.

JAN. 23RD.—LECTURE IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

JAN. 30TH.—LECTURE V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra-Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture.

ART-WORKMANSHIP PRIZES.

Articles (ninety-six in number) sent in competition for the Art-Workmanship Prizes, have been received from seventy-three competitors, and will be arranged for exhibition in the Society's rooms on and after Wednesday, the 21st instant.

Proceedings of the Society.

THIRD ORDINARY MEETING.

Wednesday, November 30th, 1864; Captain Douglas Galton, R.E., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society:—

Barnes, Joseph, 5, St. Thomas'-street, Borough, S.E.
Batson, John, 42, Brewer-street, Golden-square, W.
Dear, Alfred, Pavilion, Belgravia, S.W.
Dear, Arthur, Pavilion, Belgravia, S.W.
Forristall, Michael, The Hermitage, Forrest-hill, S.E.
Grundy, John, The Middle Temple, E.C.
Hall, J., 29, Warwick-square, S.W.
Huth, Edward, Oakfield Lodge, Huddersfield.
Lane, William James, 5, Studley-villas, Studley-road, Clapham, S.
Lord, James, St. John's Lodge, Wandsworth-common, S.W.
Monteith, James, 38, Duke street, St. James's, S.W,

Moss, William H., 19, Parliament-street, Hull.
Rochussen, Theodore Anthony, 9, Friday-street, E.C.
Saunders, Edwin, 13*a*, George-street, Hanover-square, W.
Schweizer, J. J., 28, Poole street, New North-road, N.
Scott, Rev. C. B., 19, Dean's-yard, Westminster, S.W.
Turner, Henry, St. Joseph's road, Higher Tranmere, Birkenhead.
Twentyman, William Holme, Manor-hill, St. John's-wood, N.W.
Vaudrey, Henry, 10, Norland-square, Notting-hill, W.
Walker, G. H., Rugby.

The following candidates were ballotted for and duly elected members of the Society:—

Altschul, Dr. D. H., 9, Old Bond-street, W.
Bickerstaff, William Martin, 13, Highbury-terrace, N.
Bussell, Charles, 26, Soho-square, W.
Clauson, Charles A. R. (Messrs. Rogers, Bros., and Co.), Naples.
Clutton, Robert, Hartswood, Reigate.
Craven, Joseph, Dole Mill, Thornton, near Bradford, Yorks.
Crowther, Wm., Chemical Works, Gomersal, near Leeds.
Darkin, Charles James, 21, Victoria-terrace, Finchley-road, N.W.
Dyer, George, 90, Regent-street, W.
Eskell, Abraham, 8, Grosvenor-street, W.
Evans, John James, Rose-bank, Rock-park, Birkenhead.
Field, John Lyon, Upper Marsh, Lambeth, S.
Ford, Herbert, 8, Pier-road, Erith, S.E.; and 1, Charlotte-row, Mansion-house, E.C.
Frean, G. H., Mill-street, Dockhead, S.E.
Gilbert, Arthur, 12, Claverton-street, Pimlico, S.W.
Green, German, 7, Helmet-row, Saint Luke's, E.C.
Hannah, Robert, 2, Alfred-place West, Brompton, S.W.
Hart, John Matthias, 76, Cheapside, E.C.
Haysman, Jas., F.R.G.S., Burdett House, Burdett-rd., E.
Hollow, Richard Welch, York.
Hudswell, W. S., New Railway Foundry, Leeds.
Huggon, William, 30, Park-row, Leeds.
Lainson, Henry, Heath-house, Reigate.
Leycester, George Percival, 6, Oak Hill, Hampstead-road, N.W.
Locket, George, Acton-house, Rosslyn-park, Hampstead, N.W.
Mather, William, Chester-road, Manchester.
Morres, Edward, 43, Parliament-street, S.W.
Nosotti, Charles, 398, Oxford-street, W.
Oertling, Ludwig (Ladd and Oertling), 27, Moorgate-st., E.C.
Oram, John White, 7, Bank-buildings, E.C.
Payne, James Bertrand, 44, Dover-street, W.
Page, Nathaniel, Stag Brewery, Pimlico, S.W.
Pankhurst, R. M., LL.D., South King-street, Manchester.
Robinson, James Edward, Pontefract.
Smith, Joseph, 3, Percy-villas, Wells-st., Hackney, N.E.
Snooke, William, 6, Duke-street, London Bridge, S.E.
Talbot, Robert, Strand-on-Green, Chiswick, W.
Taylor, John, 45, Connaught-terrace, W.
Tucker, Silas, 54, Canonbury-park south, N., and 234, High Holborn, W.C.
Turnbull, Thomas, jun., Whitewell Dockyard, Whitby
Venables, William Vernon, 6, Queen-street-place, E.C., and 20, Canonbury-villas, N.
Wagstaff, John Henry, 9, Sheldon-street, Bishop's-road, Paddington, W.
Walker, W., jun., J.P., Red Hall, Shadwell, near Leeds
Watkins, Major-General, B3, Albany, W.
Watson, Edward Façon, 201, Piccadilly, W.
Watson, Thomas, 19, Highbury-crescent, N.
Wentworth, J. W. T. Vernon, Wentworth Castle, Barnsley
Whiteside, R. B., 49, Lime-street, E.C.
Whitford, Edward Edmondson, 55, Lansdowne-road, Kensington-park, W.
Willing, James, 366, Gray's-inn-road, W.C., and South Lodge, Ham, S.W.
Wilson, Captain J. H, 35, Pembridge-villas, Bayswater, W.
Wilson, George, Nunthorpe Hall, York.
Wilson, Thomas, 20, Gloucester-square, Hyde-park, W.
Woodthorpe, Edmund, 28A, Basinghall-street, E.C.
Wrentmore, Francis, 250, Regent-street, W.
Yallop, Thomas, 39, Norfolk-square, Hyde-park, W.

And as Honorary Corresponding Members.

Bonghi, Cavaliere Diego, 38, Vico S. Guiseppe de Midi, Naples.
Knight, J. G., Melbourne, Victoria.

The Paper read was—

ON THE MECHANICAL CONDITIONS OF RAILWAY WORKING TO PREVENT DESTRUCTIVE WEAR AND RISK.

By W. Bridges Adams.

This is a subject not of mere local or of class interest. In days gone by, when a man was by the mass of Cockneys esteemed a traveller if he had been to Gravesend and back, it would have interested but a very few to discourse on the means of transit, but in the present day, all men, women, and children have become locomotists, getting back to a state of nature, like the birds and wild animals, and no longer confined to the spot on which they are born and bred. And a very good thing it is for themselves and general humanity, for they thereby become educated, not in the sense of book learning, but in the sense of knowledge of men and things, expanding their thinking faculties with the more healthy growth of their bodies. We increase thereby the number of men and women, instead of mere human animals, and we increase also national power, which is not to be measured by animal units, but by the mass of intelligence, health, and physical strength —in short vitality. It is better to soar like birds than to burrow like rats; and though we cannot soar above the earth, with guiding power like birds, we contrive to skim along the surface though not quite so fast, and do not yet see our ultimate limit to speed accompanied by safety. We are fast becoming a nation of mechanicians, and each man's strength is as the strength of ten, as fast as he acquires a sound body for a sound mind to dwell in. The subject is possibly a dry one in its details, but out of these dry facts must come the growth of progress, and this must be the writer's apology for dwelling on them, though in as succinct a mode as language will permit. In criticising any subject it is but natural that the critic should devise plans for amending that which he deems wrong, and in so doing the writer would deprecate any appearance of egotism in dealing with his own plans.

In vehicular transport the contact between the vehicle and the road it moves on may be of three kinds, sliding or sledging, rolling, and a compound movement, partly sledging and partly rolling. The sliding movement may be converted into rolling by the application of water, oil, or unguents, the particles of which form rolling bodies between the vehicle and the road, as with the ship on water, or with the wine sledges used in Madeira, where the driver sluices the road beneath the sledge runners, or with the winter sledges of cold climates, where frozen surfaces supply rolling particles. If actual contact between the moving vehicle and the road take place without the intervention of rollers or lubricants, destruction must ensue by abrasion.

Where no means exist of supplying lubricants to the road surface, the next process to ease the sledge is to place rollers under it. If the rollers be true cylinders, and are not fixed to the sledge, and the movement be in a straight line, there will be absolute movement without friction. If the rollers be fixed to the sledge, by axles passing through them and bearing the load, the friction will be transferred to the surface of the axle from the surface of the road, and will be greatly reduced if the oil or unguent forms an efficient lubricant. If the roller

bears on the road through its length, and be a true cylinder, it will move forward in a straight line. If it be of a conical form it will move in a curved line corresponding to the cone. But if two coned rollers be fixed to the sledge with their axles parallel, the movement will be partly sliding and partly rolling, with great friction in a straight line. If the two coned rollers be not parallel, but are arranged with their axles in converging lines corresponding to the cones, the machine will move in a circle, the centre of which will be the point where the converging lines intersect each other.

The ancient Greek and Roman cars were mounted on rollers, *i.e.*, a pair of wheels connected by a fixed axle running between thole-pins, such as up to the present day we see in the wine-cart of Portugal and parts of Spain, which are unfitted to turn corners, and make so fearful a squeaking when running out of a straight line as to give rise to the jest that they are so ordered to give warning to the custom-house officer in case of smuggling. Double-roller cars also existed, with fixed parallel axles, and this faulty mechanism was probably one cause why the old Roman roads were made in straight lines, as it was easier for such cars to run up hill than to follow curves. Even supposing the case of four-wheeled cars with two wheels running independently on their axles, these cars could still only run in straight lines as long as their axles were rigidly parallel; and in England it was only during the reign of Queen Elizabeth that what were called "turning carriages" first existed, *i.e.*, with a mechanism that permitted the axles to depart from their fixed parallelism to pass round curves.

When railways, as distinguished from tramways, were first commenced, the faulty mechanism of the early classic cars was resorted to as a cheap structure—cheap in first cost. Wheels proper were ignored—*i.e.*, wheels running independently on their axles—and rollers were used, *i.e.*, two wheels fixed to a shaft or axle which revolved with them in thole-pins, or what are now called horn-plates. And, whether two axles or three or more were used, they were always rigidly parallel. And this is the common practice in England to this day.

What are called tramways are formed of flat plates of iron, with rising edges to keep the wheels in track. Ordinary wheels, revolving independently on their axles, were used on them. Their mechanical disadvantage was that dust and dirt accumulated on the horizontal plates, and the wheels rubbed hard against the rising edges as against kerbstones, and caused much friction. Opinions are divided as to the origin of the term tramway, whether derived from an originator named Outram, or from the word "trammel," to curb or guide. The term "plate-layer," on railways, is evidently derived from the original tram-plates. On railways proper, what is called the edge rail is used, in which the increased depth gives greatly increased strength to support the load, and at the same time dust and dirt have little chance of remaining on the rails. But to keep the wheels on, the rising ridge or kerb of the tramway is transferred to the wheel, in the form of a flange. It is clear that vehicles with fixed wheels and parallel axles are only adapted to move in straight lines. If the axles were converging, the vehicles would only move in curved lines. But there is another common condition, a result of faulty workmanship—parallel axles not at right angles to the line of traction; in this case the machine becomes a sledge under all conditions, with the wheel flanges constantly grinding against the rails.

With a view to compensate, on curved lines of rails, for the different lengths of pathway on the two rails, it has been a practice to make the wheel peripheries conical instead of cilindrical; *i.e.*, each pair of wheels fixed on the axle being practically a garden roller, with the central portion removed, are made at each end a frustrum of a cone, with the smallest diameters outside. Were the roller solid, *i.e.* were the coned lines prolonged till they met in the centre, the roller, if balanced, might run in a straight line, or it might run in a curved line to right or left, if bearing on either cone, the curve being regulated by the angle of the cone. This would be the case with a single roller. But it is a fallacy to suppose that two or more rollers fixed in a frame, with their axles permanently parallel, would follow the same conditions, even though sufficient end-play were allowed between the flanges and the rails to make the differing diameters across the breadth of the tires available to compensate for the differing lengths of the rails. The movement in a straight line might be free rolling at low speed, provided the cones had sufficient lateral movement or end-play, but on curves it would only be sliding or sledging. But if the frame were so arranged that the axles were permanently out of parallel by reason of careless workmanship, the machine would be a constant sledge both on straight and curved lines. So also if the axles were perfectly parallel, with the wheels in the same plane, but were not placed at a right angle with the line of traction, the result would be constant sliding friction.

In any of these four conditions—whether a truly constructed frame, with parallel axles, or badly constructed with axles out of parallel, or badly constructed with parallel axles and wheels out of plane, or not at a right angle with the traction rod, though the first may roll at intervals under a favourable condition, the three latter must always slide, and the resistance to traction will be in proportion to the roughness of the rails and the load on them. With a light vehicle, little loaded, smooth wheels and polished tires and rails, and especially if they were lubricated on the surface, the resistance might be very small. Nay, a sledge might even be better than a wheeled vehicle, if only the condition of a lubricant could be retained. But a lubricant on the rail is inadmissible, first, because it would cause dirt to adhere to the rail, and secondly, it would defeat the condition of adhesion essential to the traction by the locomotive engine. The engine needs the greatest possible amount of adhesion, corresponding to the steam power. The vehicles should be so constructed as to minimize the amount of resistance. But as at present constructed, the vehicles on a railway are in principle a reproduction of the old Roman cars on two rollers, with such variation as a better or worse condition of workmanship or lubricant may induce, and the change from a common road to a railroad.

Axle friction, under the best conditions, is commonly estimated at about four pounds per ton of load, but this is usually doubled by a condition that under the best treatment ought scarcely to exist, viz., "rolling friction" *i.e.* the friction of the tires on the rail, and thus at a moderate speed on the level, eight pounds per ton is estimated as train resistance. But this, it is well known, is very far short of the real resistance in practice, which by quick curves and bad structure may be quadrupled and quintupled, varying with the speed of movement.

A river running with a slow movement may pass along a winding channel without disturbing its banks; but the same river, with its speed increased by sudden influx of water, seeks to make a straight course, and cuts away its banks, or *rives* them, in a mode corresponding to its etymology. Even so, a railway train at high speed becomes a *river* of the rails, at an increased cost of coke converted into steam; and, like the river water, it produces debris, not in the form of gravel, but of black iron powder, as anyone may verify by rubbing his finger along the rails after the passage of a train. This is frictional destruction, increased or diminished, in proportion to the load on each wheel.

But there is yet another element of destruction—percussion or blows, which take place between wheel and rail, friction and percussion being the only sources of mechanical destruction on railways—the others being chemical. It is quite clear that were a train to stand still on a railway, and never move, it might rust and rot, but it would not wear out, and though the proverb is a sound one "better rub than rust," it is still better to do neither. The movement of the train begins the great destruction,

and it is want of compensation for irregularities—a condition never disregarded by nature—that causes the destruction. The wheels, when running on unequal paths, induce great torsion of the axles by friction on the rails. At bad joints or uneven surfaces the wheels jump from the rails, and they then recover their normal position, by the axle as it were unwinding itself, like a discharged spring, and striking a violent blow on the rail. Sometimes the wheels, with the axles in a state of torsion, drag along for a considerable distance, heavily loaded, and this is a fruitful source of axle breakage, as well as of rail destruction. Again the flanges strike against the rails from side to side, and a constant succession of blows and vibrations is induced throughout the whole of the train. And with long vehicles, on sharp curves, there is a constant tendency to grind the flanges and burst out the rails. The rapid wear of wheel tires and rails yields ample evidence of this, and the probability is that at high speed the movement is as much sliding as rolling—side as well as forward sliding. But for the partially polished surfaces of both wheels and tires facilitating slip, at the loss of adhesion on the driving wheels, it is probable that the destruction would be much more rapid.

Are there proofs needed of all this? Time was that rails of 60 lbs. per yard, and Staffordshire tires too tough in texture to break, were capable of considerable duration. They have gone by, and rails, after various experiments in making them harder in iron, have grown to 84 and 90 lbs. per yard, and now with Bessemer steel for metal; and tires, after running through the phases of Park-gate, Low Moor, and Leeds, and various plans for steeling their surfaces, have now culminated in Krupp's solid steel.

It is many years since the writer became aware of the importance of elastic action, even on wood wheels used on highways and paved streets, to induce durability, and facilitate traction, when high speeds were needed. In the structure of the ordinary wood wheel the strength resides in the tire, which keeps the weak frame together. Originally, wheels were made vertical, *i.e.*, with the spokes all in a plane, and the width of base was determined by the ruts or hollows which pervaded all roads, giving a kind of fixed gauge, much as rails do now. The bodies were placed between the upper part of the wheels; and when it was needed to widen the bodies, the wheels were made in the form of a cone, or what is called "dished," the axle arms being pitched downwards to keep the lower spokes vertical, with an idea of strength, while the upper spokes inclined outwards with a considerable angle. The fellies and tire were made conical, to preserve a flat tread on the ground. It is evident that as these wheels revolved, they were constantly grinding the road, the outer side of broad wheels being considerably less in diameter than the inner, while the vertical spokes were continually driving into the nave and loosening the framing.

After trying some experiments with wheels in which hoops of elastic steel were used to connect the periphery with the nave, instead of spokes, the writer had some made with the section of the wood spokes reversed. The ordinary mode is to make the spokes deepest from back to front, but in the improved samples they were made broad in the plane of the wheel, and thin from front to back. As this was a bad form to fasten in the ordinary nave, it was dispensed with, and a pair of disc plates was substituted, between which the spokes were mitred together and bolted. One felly was used to each spoke, instead of the ordinary practice of one felly to two spokes, and when cylindrical tires—not conical—were shrunk on, the spokes curved from back to front, and the wheel, instead of being a rigid cone, or dish, became an elastic dome, each pair of opposite spokes radiating from the centre, representing the form of an archer's bow. The fastening of the tires was through the joints of the fellies. When applied to a straight axle, with the arms not pitched downwards, the load was carried, not on a rigid vertical, but on a bent inclined spoke, and the result was that the load was not only carried more easily, but the wheels were, for their scantling, the most durable ever constructed.

In the early railway wheels the principle obtained of neglecting the structure of the frame, and making it depend for strength on the shrinking of the tire, just as wood wheels were made. One result of this was the flattening of the tire between the spokes, and a tire of unequal thickness, when turned in the lathe to make the external periphery a true circle, and a consequent rapid destruction in wear. This applied to the wheels with the wrought-iron spokes. The truest formed wheels were those of cast-iron with a wrought tire. They might break if of careless moulding, but they would not otherwise alter their form, and the tires could be all of equal thickness. But upon rigid cast-iron wheels the tires became exposed to very rapid destruction as the loads increased.

The writer had early turned his attention to the importance of wood wheels for railways, and as far back as the year 1838 caused some to be constructed with two rows of fellies, break-joint between the tire, and a cast centre. They worked well, and the writer has been informed that they still exist. The difference between these wheels and the modern wood wheels is that they had the elastic side grain on the tread, whereas the modern wheels have end grain. The reason for substituting the latter less perfect method probably was the difficulty of ensuring dry timber on a large scale, and wood shrinks scarcely at all endwise, so that the shrinkage involves less evil.

Wood wheels on railways are, as now made, solid discs, and therefore the frame preserves its circular form without being excessively rigid. Iron wheels have also been made in the disc form, both in cast and wrought iron; but, then, extreme rigidity rendered the destruction of the tires a very rapid process;—the tire was between two anvils—the frame of the wheel, and the rail supported on chairs of cast iron.

To prevent this destruction the writer early devised a wheel in which the spokes were all springs, but that did not answer, because the bending of the spokes prevented the wheel from running true. The next plan was to apply a hoop of elastic steel between the tire and the periphery of the wheel, with a hollow below the steel. The wheel was retained in the tire by a rising rib in front, solid with the tire, and by a lower rib behind, sprung into a groove of the tire. Models are on the table and a section on the wall.

The plan was satisfactory in theory, but how to put it in practice was another matter. A railway was needed, and railways are not to be found in a private field or park; they are the highroads of the public, and in charge of officers whose first care is to take no risk by an unknown plan; for if an accident happens through a known plan in common use, however faulty in its mechanical philosophy, a jury will acquit the manager of all blame. But if the accident happens with a novel plan, however theoretically right it may be, the jury will probably condemn it as new-fangled, and saddle the manager or engineer with the blame; and thus there is a natural indisposition in engineers to step beyond their tether into the unknown, and they can hardly be blamed for their caution.

So the writer went forth on his propaganda to expound an unknown quantity, but few would even listen to him, and none would believe; but strong in faith he persevered, and at length found an engineer with a logical mind, in the locomotive superintendent of the North London Railway, Mr. William Adams. The writer demonstrated his principle, and Mr. Adams was unable to disprove it logically, whereon the writer remarked, "If you cannot demonstrate it to be wrong, and I demonstrate it to be right, and that the result if successful must be very advantageous, you are bound to try it." He agreed to this, and said "I will try it, though doubting greatly. What wheels will you apply it to?" "Those most destructive to tires."

So a set of wrought iron disc wheels were selected, and Staffordshire tires were applied to them on hoop springs, and they were placed under a heavy carriage. At the same time a set of ordinary spoke wheels, with a set of Low Moor tires fixed in the rigid mode, were applied to a similar carriage. The Low Moor tires required turning up to restore their surface after running less than 50,000 miles. The Staffordshire tires on springs ran 106,000 miles without turning up, and with no alteration of form, and were then taken off to exhibit, and may still be seen in the same condition.

There is no mystery in this. The Low Moor tires were exposed to severe wear. First, because on curved lines they were necessarily forced to slide on the rails, both forward and laterally. Secondly, because they were rigidly fixed, and possessed no elastic yielding to elude blows. Thirdly, because on curved lines there was a constant torsion of the axles causing incessant jumping. Fourthly, because the tires had no power of lateral movement to suit the varying inequalities of the rails. In short, there was no compensation for irregular movement, and the result was a constant grinding of the flanges and treads.

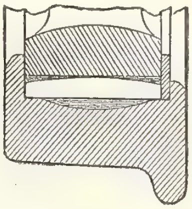
With the spring tires, on the contrary, there is universal compensation. First, there is no tendency to blows, because the elastic cushion preserves constant contact between tire and rail. Secondly, there is no torsion of the axle or slipping of the tires on the rail because the wheel can, on curved lines, slip in the tire on the smooth surface of the spring without damage, thus equalising the pathway. Thirdly, the tire can rock laterally on the wheel to adjust itself to the bearing on the rail surface, which any one may observe to be constantly varying, sometimes the middle of the rail being most prominent, sometime the inside edge, and sometimes the outside. No other class of wheel can supply these various compensations.

Important as these wheels are for vehicles which are simply drawn, in order to remove resistance, they are still more important for engines with the load greatly increased, and especially for driving wheels—more especially for engines with four coupled drivers. It is obvious that if two wheels of equal diameters be fixed on the same crank shaft they must grind and drag on curved lines, and the torsion thence ensuing is the main cause of the breakage of crank axles, which it is difficult to make strong enough for their work, the axle being in reality a a very long axle, as would be readily apparent were it stretched to a straight line—between eight and nine feet long on the narrow guage. When four wheels are coupled, the diameters very rapidly alter by irregular movement, and the adhesion may actually become disadvantageous, retarding the engine by friction, like a brake. It is clear therefore that the power of slipping the wheel within the tire to compensate for curves and irregularities becomes a question of the greatest importance, both as to facilitating haulage and preventing the wear of tires.

It has been at times assumed that the slip of the tire on a wheel must defeat the purpose of haulage. But when it is remembered that the bearing of the wheel is over half the diameter by downward pressure, and that with a heavily-loaded wheel a slight flattening of the tire takes place, it is obvious enough that slip will only take place by excessive friction on the rail; this is the true theory, but, for the satisfaction of those who only believe in practical results, it may be stated that the experiment has been tried repeatedly, and it has been found that when the tires were so loose on the springs as to be turned round by hand with the wheel lifted, the haulage was in no way affected. On a London line, of sharp curves, where the leading tires of ordinary engines with parallel axles had their flanges constantly ground off in two months' wear, a bogy-engine was set to work with a turning centre to radiate the leading axle to the curves. At the same time a similar sized engine, but with parallel axles, was applied with spring tires to the leading wheels. The result was that in both cases the leading flanges were saved from damage, and ran three times the ordinary distance. The yield of the springs had an effect similar to that of the play of the axle to right and left in the bogy, when truly centred, for if not truly centred the flanges wore unequally.

These spring tires were adopted on the engines of the St. Helen's line, by Mr. James Cross, the engineer. That line is an incessant continuation of sharp curves and gradients, some of the latter 1 in 35, and some of the former two chains radius. The spring tires were first applied to a six-wheeled engine, all coupled drivers of 4 ft. diameter. They were all of Staffordshire iron. At the same time another engine of less weight, also on six wheels, but of 4ft. 6in. in diameter, and only four coupled, was fitted with tires of Krupp's steel. After running 41,000 miles, Krupp's tires were so deeply worn as to need turning up, while the Staffordshire iron tires ran 65,000 miles, and then only required the flanges to be reduced which had been deeper at the outset, the tread of the tire remaining in good shape. Taking into consideration the difference of diameter, the distance run by the Staffordshire iron was as 72,000 against Krupp's steel 41,000. In practice, Krupp's tires were found to slip on the rails even in dry weather, but the Staffordshire iron was scarcely ever known to slip, though working steeper gradients and sharper curves.

Another set of experiments was tried with two fellow engines, one of them fitted with spring tires, the other with rigid tires, up a gradient of one in 80, during a whole day, by the same driver. The result was, that the rigid tires constantly drew up thirteen loaded coal wagons, and the spring tires fifteen.



The result of this elastic principle having been so unmistakably advantageous in wheels, the writer began to consider whether the same principle might not be practically applicable to rails also. It is clear that the destruction of rails arises from blows between the wheel tires and the rails, increased in destructive effect in proportion to the load, and therefore it is, that it is now proposed by some railway companies to substitute steel for iron in rails as well as tires.

On the North London Railway the rails are 82 lbs. per yard, and their average duration on the main line does not exceed four years, if so much, the traffic on each pair of rails being upwards of 120 trains per diem of goods, coal, and passengers. The great wear is not owing to wear of attrition, but to crushing, disintegration of the laminæ. The rails are double-headed, and worn out on both tables before they are taken out. The sleepers are three feet apart, and the rails are fixed in cast iron chairs with wooden keys, the joints being fished with long fishes and four bolts.

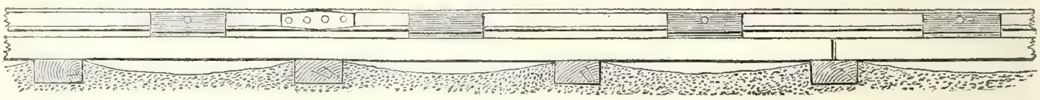
Iron rails are in their manufacture practically "scrap iron." They are formed of bars of various sections piled together and heated, and then rolled out. In the act of heating, the oxygen of the atmosphere gets access to their inner surfaces, and scale is formed. This scale does not roll out, but rolls in, keeping up a constant separation of fibres like the grain of wood. With a certain intensity of blow on the line, the chairs and sleepers serving as anvils, the fibres are crushed apart, and the utility of the rails is destroyed.

Steel rails are not formed of separate masses welded together, but each of a single ingot rolled out without flaw or imperfect junction. They are homogeneous, which

the iron is not, and therefore do not disintegrate with the same amount of blow which disintegrates the iron. But to be safe, the steel rail requires to be not only homogeneous in metal, but in the temper of the metal also. If a steel rail be taken hot out of the rolls and thrown on a cold iron or stone floor, it may become partially chilled—hard and soft—and in this condition it is apt to break, for which reason it is always recommended to keep the steel rails as soft as possible, to prevent risk, in fact to reduce them to the condition of iron. But the better plan would be to use spring steel, and harden and temper it.

There is a notion prevailing that permanent way on cross sleepers is elastic by virtue of its discontinuous bearing. But it is obvious that if there be any yield of the rails between the supports, there is none at the chairs themselves. If the rail be loose in the chair, which it commonly is, and if the sleepers be loose in the concreted ballast, which they are commonly, the looseness only serves to give momentum to the blows of the wheels, so that the rail drives into the chair, the chair drives into the sleeper, and the sleeper drives into the ballast, while the fish joint bends at the weakest point.

On a portion of the main line of the North London, the rails and chairs being taken up, longitudinal timbers, four inches deep by eleven inches wide, were spiked down to the sleepers. On these longitudinals, midway between the sleepers, were placed cast-iron brackets in which the rails were fixed, suspended by the upper table, and not resting on the lower table, as in chairs, the bottoms of the rails being $1\frac{1}{4}$-inch above the longitudinal timber, so as not to touch it. The joints were fastened as usual. The cross sleepers were packed hard and tight on solid ballast. The longitudinal timbers were not packed, the result being that the rails were continuously supported on an elastic base. With the traffic of the trains the mechanical action was, that no wheel pressed directly on a single sleeper with a hard blow, but that the weight on each wheel was distributed over two or more sleepers, and that through an elastic medium. Practically, after nearly three years' wear, none of these rails have been found to disintegrate, but are as perfect as when first laid down, except where connected rigidly to the ordinary line, and there the ends of the rails are split; and the elastic action is not merely vertical, but horizontal also, by a slight twist of the longitudinal timbers preventing side blows from the flanges of the wheels.

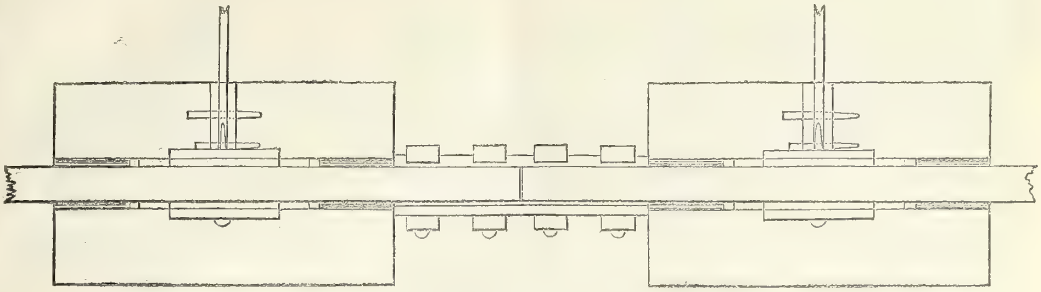


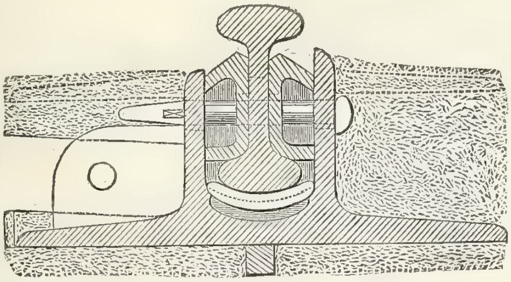
It was also found that the sleepers remained quite undisturbed in the ballast, owing to the distribution of the weight, and that they really became *sleepers*, instead of dancing up and down. Moreover, the provision for elastic action dispensed with the practice occasionally resorted to of digging up the ballast below the sleepers to soften it, and prevent the extreme rigidity. It is getting to be a known fact that constant traffic and the use of heavier engines and vehicles is gradually solidifying the whole of the railway lines, so that the destruction of the plant, both fixed and rolling, is on the increase. A superintendent of a long line running on hard ground informed the writer that he contemplated re-spacing the whole of his sleepers in order to use the softer intervals. An illustration of this great evil may be found in the fact that in the winter time, when all the ground becomes hard with frost, the destruction of wheel tires and rails by breakage, is greatly on the increase.

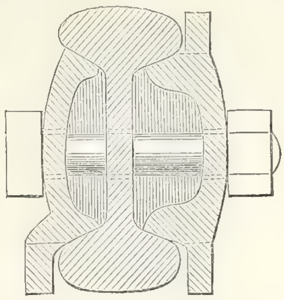
After the successful result of the first experiment on elastic lines, the superintendent of permanent way, Mr. Matthews, laid down a second portion, in which the cross-sleepers are six feet apart, or double the ordinary distance, the supports of the rails on the longtitudinals being three feet apart. The same result was obtained in preserving the sleepers steady in the ballast, though the elastic yielding was greatly increased, being quite perceptible under the rolling trains.

Ballast in England and elsewhere has become a kind of stereotyped custom on railways, though there are districts, as Egypt,—the Southern States of America—where a driver "guesses he never run on ballast but only on mud roads"—the Pampas of Buenos Ayres, the Llanos of Venezuela, and elsewhere, where no ballast can be had, and so it is dispensed with. But the theory of ballast has hardly been considered. It was originally used on non-porous soils, as a kind of easy drainage for surface water, and in some places tolerably cheap. And it does not yield like clay. But it very soon ceases to be porous under the sleeper, and becomes a kind of conglomerate, or concrete, each sleeper pit holding water like a pond. But inasmuch as it has been practically demonstrated that with a provision for elasticity the sleepers may advantageously be rigid fixtures, there seems to be no reason why the whole surface of a railway should be covered with eighteen inches of gravel or broken stone, varying in price from 1s. to 2s. 6d. per cubic yard. The object should be rather to cover it with non-porous material, so as to keep out the surface water, the same principle on which we pave the footways of our streets; and there is no doubt that it would be cheaper in many cases to use stone flags or cast-iron for sleepers, rigidly fixed and overlaid with elastic longitudinals, so as to dispense with ballast, even in first cost, saying nothing of the saving in maintenance. As regards such lines as are constructed on brick arches, the elastic system would prevent the vibration which so commonly disintegrates them, and, by ramming down the ballast, forces out the parapets; and it would be better to cover the surface with non-porous material, such as paving stones, and get rid of mud and dust altogether. The action of this novel system depends upon the elasticity of the longitudinal timber, but inasmuch as there are circumstances in which timber is inadmissible, such as very hot climates, or climates of great heat and moisture combined, or alternating, the writer was led to consider whether it might not be practicable to obtain the elasticity by the agency of metal. This can be done in two methods, substituting a broad **T** iron for the longitudinal timber, or by applying springs of tempered steel beneath the seats of the rails, which in that case cannot be suspended by the upper table, but must rest below the vertical web, being supported between the bracket sides with provision for the small amount of movement required. Two models of cast sleepers are on the table, with elastic steel bases. The cost of them will not exceed ordinary iron way, as great weight of metal is saved.

It is desirable that the rails should be of such depth as not to deflect beneath the wheels, and also that they should not deflect laterally, for which reason the tables should be of ample width. It is also important that the rails should be so joined together as to form non-deflecting bars at the joints, though with provision for expansion and contraction. In examining the ordinary fishes it will







be perceived that the original principles of the writer's invention have not been carried into effect. These fishes, as ordinarily used, are parallel bars, about eighteen inches in length, and with four bolts to attach them to the rails. As the total depth of the fish is only between two-and-a-half to three inches, it is obvious that a pair of three inch bars cannot possibly be equivalent in strength to a rail five inches in depth, and provided with two broad tables. In order to compensate for this defect in some measure, the fishes are made as thick as possible, approaching an inch, making them very rigid. They are wedge-formed between the rail-tables, but at an obtuse angle, not an angle of repose, and they depend wholly on the bolts to keep them in position under the action of the trains, and the slightest movement of the rail loosens them. For this reason the bolts are made as large as possible. The large hole weakens the fishes, and it is necessary to drill the holes, as punching distorts a narrow thick bar. Moreover, as the fish is as thick at the ends as at the centre, the result is a blow from the wheel at the fish end, where it is too strong, and a second blow at the joint where it is too weak, and a gradual dent of the fish-end into the rail, and another dent of the rail-end into the fish; and when these dents begin to form, the process of destruction is certain; rust is formed, rubbed off, and begins again, and the noise and jolt is rendered very perceptible to the passengers before the cause is detected by the eye, except when a train is passing, when the deflection is very perceptible.

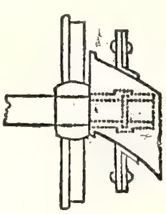
To remedy this evil, the writer has devised a true form of fish. It is tapered from the ends towards the middle, where it is the full depth of the rail on the outside fish, and on the inner the full depth of the rail, less the upper table to make room for the wheel flanges. Angular ribs are rolled on the inside of the fishes, to fit accurately against the rail tables, and the fishes are arched laterally. The metal being thin, except at the ribs, they are easily punched without distortion, and when the bolts are screwed tight, the arches of the fishes flatten and press the ribs against the rail tables firmly. The bolts thus acting on elastic surfaces, the nuts remain tight, and the joint is elastically firm. The models of the elastic way, both in timber and iron, with steel springs, as well as the improved fish joint, are on the table.

The writer has dwelt upon this subject the more earnestly because on any new plan connected with a railway, a protracted experiment is needed for verification, and this protracted experiment of elastic railway has been made, and can be examined by all who feel an interest in so important a subject.

Having obtained successful results in the elastic action both of wheels and rails, the next question was to obtain a true mechanical action in the movement of wheels and axles. As far back as the year 1837 the writer had sought to impress upon railway authorities the importance of radial movement in the axles, enabling them to run at a right angle with the rails, whether on straight lines or curves, and proposed various modes of accomplishing it, but he could get no attention. The railways were made in what were called straight lines, though practically crooked lines, and it was taken for granted that the coning of the wheel tires accomplished all that was wished. But in America crooked lines obtained with very sharp curves, in order to go around street corners instead of outside the towns, and a bell was suspended at the entrance, to be struck by the engine, and a notice painted on a maple slab, "Look out for the locomotive, when the bell rings." To facilitate the movement of the engine round the curves, the front end was provided with a swivelling truck, called a bogy, analogous to the ordinary under-carriage of a road vehicle, moving on a centre pin, but with four wheels instead of two, the wheels being guided by their flanges against the rails, instead of by a pole. This was so convenient, that it came into general use in America, and it was first introduced into England on the Birmingham and Gloucester line, the engines being made in America. But it was defective in principle. In ordinary under-carriages on the road, the length of the pole steadies the wheels. In the four-wheel bogy, the distance between the front and back wheels was less than the width between the rails, and, consequently, swivelling on the centre pin, the bogy was apt to run unsteadily, and drag the wheel flanges against the rails, the contact with the outer rail on curves setting the axles askew to the rails. This evil was continued on the South Devon line, where, the sharp curves necessitating

the use of the bogy, it was applied on a seven feet gauge with the wheel centres five feet apart. In addition to this defect, apparently resorted to to compensate in some measure for the fixed parallelism of the axles, it did not in any way help the skew position of the driving wheels, as the central pivot did not permit lateral movement of the bogy. To remedy this, Mr. Bissell, in America, devised a plan of removing the centre pivot from midway between the four wheels to a point between the driver and the bogy; thus the movement of the wheels became radial, or in the circumference of a circle instead of the centre. This was a plan on which the writer had built road carriages long previously, under the name of Equirotal carriages, and had proposed to apply the principle to engines. Mr. Bissell subsequently applied the same principle to engines with two-wheeled bogies, and time and circumstances having forced on the attention of English engineers the necessity for radial movement, other attempts were made to correct the defects of the bogy, and one was by providing a lateral slide as well as pivot movement to the ceutre. But on this plan the guidance was lost, and it was not found to answer.

Seeing that the time was approaching for more perfect machinery and for radiating axles, the writer again set to work to simplify the structure. Abandoning the truck form, or bogy, altogether, the axle-boxes were adapted to slide in curved lines laterally through the horn plates of a rigid engine frame beneath the spring bearings. The advantages gained by this were, first, true radiation of the axle to every curve, from the straight line down to one chain and a half radius; secondly, perfect guidance and prevention of irregular movement in the wheels; thirdly, facility in axle bearings snd lubrications; fourthly, the use of larger wheels than could be obtained by the bogy system.



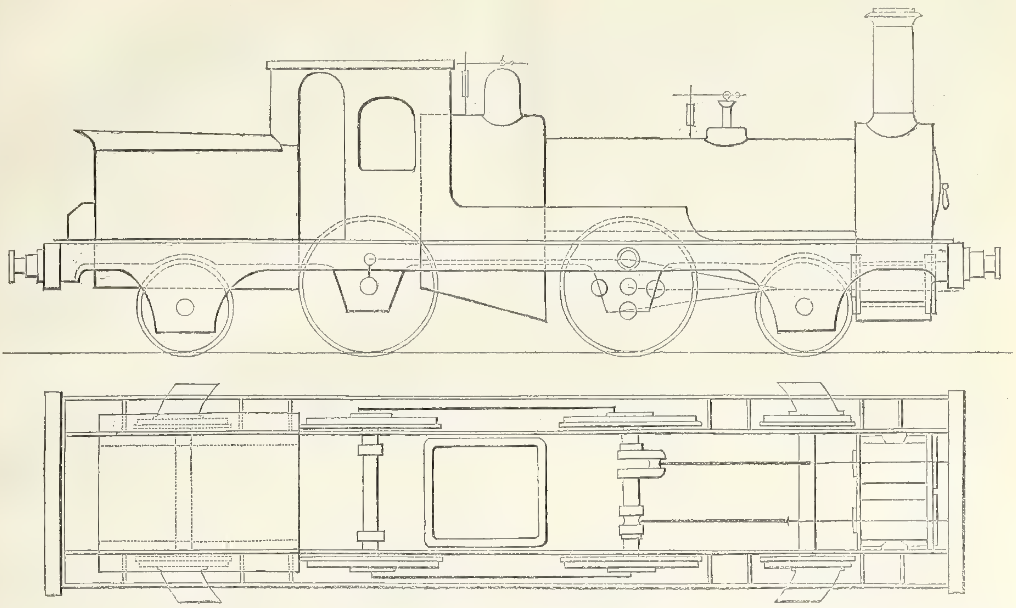
The writer proposed to build the engine with coupled driving wheels in the centre, and with radial wheels at the ends, eight wheels in all, and so, having ample support, to dispense with a separate tender. This was so novel a plan, departing from the customary bogy system, that it was not listened to, and bogies were continued.

The writer sent a drawing to Mr. Cross, the engineer of the St. Helen's, and about nine months after received a letter from that gentleman stating that having found it necessary to use larger engines for his increasing traffic, he had studied the whole question carefully as to the best principle of radiation for his sharp curves; and having come to the conclusion that the plan of the writer was the simplest, safest, and most effective, as well as the least costly, he had constructed a model and verified it experimentally, after which he put in hand a full sized engine. (A large-sized model frame of this may be seen on the table.)

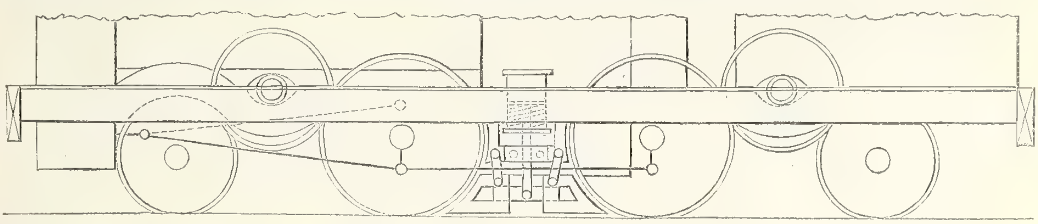
After working for some time on the St. Helen's, both for passengers, goods, and coal, and perfectly establishing the soundness of the principle, this engine, called the "White Raven," was brought to London for experiment, and examined and experimented on by a large number of railway engineers, whose judgment confirmed the truth of the principle of structure.

It was at first supposed that the free movement of the wheels would tend to make the engine unsteady on straight lines at high speeds, inasmuch as front wheels, fixed laterally in the horn plates were supposed to exercise a steadying and governing power. But the contrary proved to be the fact. Another engine, altered from the rigid system to the radial, was found to run much steadier after the alteration, after acquiring the facility for rounding sharp curves. In truth the unsteadiness of all engines, apart from bad construction, arises from the fact that the wheels, fixed to the frame and seeking the path of least friction over uneven rails, force the frames to partake of their irregular movement; and, as might be expected, the inertia of the engine frame keeps it steady enough when the wheels are left free to pursue their own courses unshackled.

This novel arrangement comes at a convenient time, as the extension of railways through towns and mountainous countries is now the prevalent thought. But even for what are called straight lines, their extension into and through towns, and new station accommodation, renders it very important to have engines working round very sharp curves, and either end foremost. The great cost of land and the removal of buildings in approaches where only straight lines or very large curves can be used adds very materially to the cost of construction. But there is another question, quite as important. It is well known that the rapid wear of the rails of railways is very largely owing to the weight of the engines, apart from the train, and in the engines the destruction by rail crushing is increased in proportion to the weight on the driving wheels. Some engines have only one pair of driving wheels, as they involve less impedimental friction at high speeds. Some have two pairs coupled together, and some three pairs. Inasmuch as the engine draws the load by reason of its own weight on the rails giving adhesion, it follows of course that a heavy train needs more weight on the driving wheels than a light one. When a single pair of drivers are used the load sometimes approaches to fourteen or fifteen tons, and this crushes both rails and tires. If however the load can be distributed over more wheels, this destruction may be avoided. Twenty tons on four wheels is much less damaging than fourteen tons on two wheels. For this reason our continental neighbours have been aiming at two things combined—to obtain the adhesion of many wheels with the facility of passing round sharp curves. The ordinary method of coupling wheels by side rods does not admit of this, and the writer has resorted to another method, illustrated by the model on the table, which, as regards its eight lower wheels, is precisely similar to the St. Helen's engine, the "White Raven." But in addition to this, it has four other wheels, two of which are placed at each end resting between the central driving wheel and the end radial wheel on their peripheries, pressing downwards with any amount of weight needed to induce adhesion. In fact the whole weight of the engine and frame may be supported by the upper wheels if needed. But practically a comparatively small weight is needed, as the wheels do not merely rest on one another, as is the case with wheels on rails, but have also a wedging action, which may, if permitted, produce an intense pressure. All the wheels have also spring tires, which ensures elastic contact and fit, without blows. It will be seen that when the driving wheels are put in motion, they communicate that motion by friction to the upper wheels, which in turn communicate the motion to the radial wheels, and continue to do so when the radial wheels are on curves, the effect being that the axles of the upper wheels depart from the horizontal line, dipping to right or left according to the lengthening or shortening of the distance between the lower wheels on curves. And the adhesion is perfect, because the load on the upper wheels forces down the lower wheels to a perfect pressure on the rails at either end of the engine. Thus there are eight drivers which may be equally loaded and the whole weight of the engine is available for adhesion. And in reversing, for the purpose of retardation, the whole of the wheels are available. To make the machine complete, brakes are applied between the driving wheels, arranged to act both against the wheels and rails by small steam



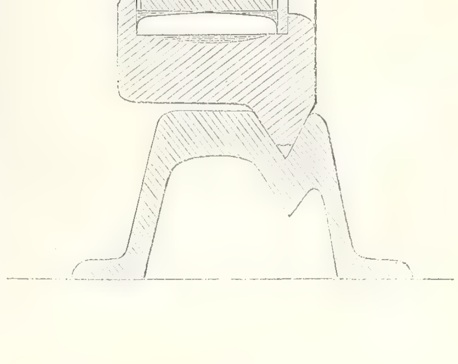
cylinders, so that the retardation of the engine is within the control of the driver by simply turning his regulator and steam cocks, without needing the muscular force of his fireman, labouring at a screw with slow movement. It will be seen that this engine will run on S curves as easily as on regular curves.



Of course the steam power of an engine should be in proportion to the adhesion. Practically it is far in excess of the adhesion, inasmuch as sand is commonly used to prevent the slip of the wheels; and this, though useful to the engine, is a serious disadvantage in increasing the resistance of the train. This seems certainly the case on the Great Northern, where it is found advantageous to make the tender wheels drivers, as well as those of the engine, with the same boiler power.

In the early days of railways the difficulty of adhesion between a smooth tire and smooth rails was considered to be great, before it was tried. But in those days the trains were light, and the increase in weight has again drawn attention to the desirability of increasing the adhesion. Racks on the rails and wheels might no doubt be used, as they have been, and as they are still in some collieries; but this can only be for very slow movement. Yet there is a mode of increasing adhesion not yet resorted to, but which will probably be resorted to, where the whole difficulty of mounting steep ascents, such as one in twelve, or 440 feet to the mile, shall occur on any sharp curves. It is to convert the rounded flanges of the wheel tires into two flats at an angle of 45 degrees, and enlarging them to take a corresponding groove formed in the surface of the rail. The driving wheels of the engine only are to be fitted to these grooves, and the ordinary flanges of the train wheels can easily pass, being of smaller size. It may be remarked, that it would not be easy to lay rails accurately enough for this, and especially on curves, but compensation can be easily provided by the use of spring tires sliding laterally on the wheels, and there is no reason why the eight coupled engine before described should not work perfectly well in this mode, on sharp curves and stiff gradients. The pair of wheels on the table illustrate this principle of spring tires with angle flanges working in V grooves. The diagram on the wall illustrates this.

Thus with radial axle, spring tires, angle flanges, and elastic permanent way, several difficulties are got over. The blow and sledge movement is removed from between wheel and rail, as well as the grinding action against the flanges, and the adhesion is ensured, while the permanent way is rendered really permanent.



It may be objected to that the angular flanges will tend to wear away both tires and rails. This is quite true, but if we want to do hard work we must pay for it in some shape or other. The only question is, is it worth doing, and if so, what is the least costly method as well as the most effective and simple. We know that we can drive machinery by friction pullies, and there is no mechanical reason why we should not drive railway trains. And these tires can be removed and replaced with perfect facility without needing workshops.

But it is not merely the question of engines that we have to deal with. It is that of carriages and wagons also. These vehicles have been kept short, and their wheels disadvantageously near together, chiefly on account of the difficulty of curves. This system needs remodelling, but there are so many considerations that it must be deferred to another paper.

DISCUSSION.

Mr. Rochussen fully agreed with the principle laid down, that in order to neutralise as much as possible the wear and tear of materials by friction, they should have elasticity, and that elasticity might easily be promoted by the improvement of materials themselves, as pointed out in the paper. There was no doubt the introduction of steel into the manufacture of rails tended to add to the durability of the rails as well as to introduce the element of elasticity to a large extent. The Bessemer process enabled them to produce steel rails at a comparatively low cost; at the same time it had not superseded the other description of steel rail which was largely used on the Continent, viz., the puddled steel rail, by which the tendency to split, spoken of in the paper as occurring in the common iron rail, was obviated, and the advantage of puddled steel was, that it welded well with iron. Thus they had a flat-bottomed or Vignolles rail, which was still used to a large extent on the continent, consisting of a head and web of puddled steel, and an iron base. The welding of the steel and iron was complete, and while this combination gave a harder surface to the tread of the metal, the elasticity of the iron was retained. He had seen the advantages of that combination of material at the Hamm station of the Cologne-Minden Railway, the traffic of which was equal to that of Cresse, where steel-headed rails with iron web and base had been in use for ten years and showed no signs of wear. Bessemer steel would not weld well with iron, and therefore it was best adapted for the double-headed rail. As far as the elasticity of rolling stock was concerned, he greatly admired the plan of Mr. Adams, of introducing an elastic material into the tire of the wheel. But he (Mr. Rochussen) would remark, that the combined steel and iron he had spoken of in rails, was also applied to wheels, and offered all the advantages of elasticity contended for. Both wrought and cast-iron discs in straight section were objectionable, whilst in a corrugated section the wheels have a power of contraction which counteracted the force of the blows; and, on the other hand, they had but little vibration laterally. The great advantage of the disc wheel was that it did not raise the dust as the spoke wheel did, and obviated the great atmospheric resistance which the fan-like motion of the spokes created. With regard to the system advocated by Mr. Adams, he would ask how it could be ascertained when the piece of *lignum vitæ* or other wood inserted between the wheel and the tire showed signs of decay, as it was completely hidden from view, and there were no visible means of knowing when it became in an unsound state. While on the subject of disc wheels, he would remark that wrought-iron disc wheels, which were much in use on the continent, were working their way gradually in this country. In the Exhibition of 1862 a manufacturer, with whom he was connected, showed some driving wheels on the disc system, which weighed 2½ tons each, made of cast steel, that material being considered better than wrought iron; but it appeared that wheels of that description were greatly affected by severe changes of the temperature of the atmosphere, and in one night no fewer than nineteen of those wheels cracked, while there was no instance of wrought-iron disc wheels having given way under atmospheric influences. The iron was forged from the bloom, with a hammer weighing five tons, and the cast steel tire was batted on to the T-piece of the disc, or a puddled steel tire was used and welded to the disc, and as the steel surface of the tire wore off, it could simply be turned down, and another steel tire slipped over it, but hitherto no instance of the wearing out of such a wheel had occurred. The axles were not keyed in, but pressed into the wrought-iron nave with hydraulic power.

Mr. Dennet felt much indebted to Mr. Adams for the paper he had read, but he wished that gentleman had gone a step further, and had given them a little more information as to the means of avoiding many of the risks of railway travelling. With regard to wear and tear of the line and plant, it was a question of great importance, in which the shareholders of railways were very much interested. There was an invention connected with this part of the subject to which he would call attention. The inventor of it, Mr. Jowett, he had hoped would have been there that evening to explain it, but his sudden and unexpected death within the last four days had deprived them of the valuable information which he would have furnished. The invention alluded to was a form of fish-joint, models of which were on the table for the inspection of the meeting. For this invention he had received but £12 10s., whilst it had been disposed of to a company for £21,000, and they had realised from it £80,000. Mr. Dennet then called attention to the specimen of rails, sleepers, plates, and a new fish joint, all of which were the invention of Mr. Jowett, and he pointed out the advantages of this "rail" and mode of setting as obviating two or three difficulties in railway travelling. The ordinary rail was from five to seven inches in height, and being fixed in iron chairs on the top of the sleepers, there was a vibratory motion, which gave that zig-zag movement so unpleasantly experienced by railway travellers. In the model before the meeting the rail was set in a groove to half its depth of the sleeper; there was a slot or hole cut in the rail, through which a wrought iron wedge or plate was inserted eight or nine inches in length by four or five inches in width and one inch thick, which plate was fastened to the sleepers by bolts or spikes. By this plan there was not only a saving of wear and tear of the rail but an economy in first cost. It could be adapted to rails of any material and of any shape. It could be applied to a light but serviceable rail, it dispensed with the wooden keys and chairs, and lessened the number of sleepers by two in the length of rail. The saving in the cost of laying rails was equal to £300 per mile. In India it would be found that the economy of this plan was equal to £490 per mile, or £40,000 in 100 miles, while in this country the saving would be about £28,000 in the same length of line. Mr. Dennet added that this plan had been tested during seven months on a short length of the South-Western Railway, where it could be seen by those interested in the subject.—Mr. Dennet also exhibited a form of fish-joint which he considered novel, and highly advantageous and practical.

Mr. Zerah Colburn, on being appealed to by the Chairman, said his observations had been confined mostly to lines in America, and, as far as his experience went, it bore out the soundness of the principles brought forward by Mr. Adams. The American lines were, for the most part, imperfectly constructed, partly from the inferior quality of the earthwork and want of ballast, and to a great extent from the bad form of rail—the common contractors' rail, with a flat foot, but of bad shape and bad quality of iron. Mr. Colburn explained the form of rail generally used, showing how the contractors' form of

rail, which could readily be fished, had, owing to the bad quality of the iron, in order to gain strength been altered into a form which did not admit of fishing. Nevertheless it was the fact that the American carriages travelled over these lines as smartly as first class carriages on the superior lines of this country. This he thought was mainly due to the use of the bogy, the great length of the carriages, and the manner in which they are hung. The bogy had the advantage of going round curves easily, and the mode of attaching the carriages to it distributed the weight more uniformly; if they met with an obstruction the shock was not imparted to the carriage. The arrangement for allowing the carriage to swing freely on the body of the bogy, as adopted in America, had been introduced on the Metropolitan Railway, where it would be noticed that the carriages have a peculiarly easy motion. Mr. Adams had spoken of the bogy as having been originally invented in America, but he believed it was first introduced by Mr. Chapman, of Newcastle, in the year 1812, and was first used there. It was taken up in America at an early period, and had continued in general use ever since. It was the opinion of some locomotive engineers in this country that the use of the bogy to engines and tenders was not so safe as placing the wheels in the ordinary manner. He thought that was a mistaken opinion. He had designed some rolling stock for one of the Brazilian lines, and in opposition to his advice the bogy was dispensed with; but experience in the working of heavy gradients and sharp curves led to the ultimate adoption of the bogy. With regard to elastic wheels, something on the principle described by Mr. Adams had been used with success in the States of America, but not of the form which that gentleman had described.

Mr. Dennet inquired whether Mr. Colburn could give any information as to the description of wheel in use on the Massachusets line, which he had been informed had resulted in great economy of wear and tear.

Mr. Colburn was not acquainted with the kind of wheel used on the line mentioned. He apprehended it would be something similar to those on the South-Eastern line in this country, viz., segments of wood put together. He would, however, add that one objection to the bogy was the necessity it entailed of using wheels of small diameter. A larger diameter than three feet was never used. As a rule the carriage wheels were 2ft. 9in., and the engine wheels 2ft. 6in., and for goods engines only 22 inches. The plan of Mr. Adams enabled a much larger wheel to be used, and this was, in his opinion, a decided advantage.

The Chairman said there was no doubt Mr. Adams had introduced a very important subject for discussion that evening, advocating, as he did, a radical change in the construction of our railways and the rolling stock. On the first introduction of railways he had no doubt it was in the recollection of many that a very rigid road was made. In the first instance the rails were laid on chairs fixed into stone blocks, and on one line, he believed in the north of England, they actually built brick walls, on which they laid the rails. All those arrangements caused the rails to be knocked to pieces very soon, and engineers then resorted to wooden sleepers laid upon ballast. The Great Western Railway was, in the first instance, constructed by Mr. Brunel by laying longitudinal sleepers on piles driven a considerable depth in the ground, but at the points where these piles supported the longitudinal bearings great injury resulted. These piles were consequently all removed. The system was changed, and the sleepers were laid simply upon the ballast. This, therefore, appeared, to be the great object at which railway engineers were aiming in order to avoid or mitigate the shocks produced by railway trains. He therefore thought no one would be disposed to object to a trial of the plan proposed by Mr. Adams. To him (the chairman) it seemed a most reasonable plan; but, of course, in railway experience it would not be prudent to express any very decided opinion upon a new principle of construction until it had been tried for a considerable time. The arrangement which Mr. Adams proposed for making the tires revolve on the wheels was certainly new. It had been tried, and was a great advantage. It had long been sought by railway engineers to make the wheels revolve upon the axles. The principle of Mr. Adams was very much to the same effect. It made the periphery of the wheel the point at which the revolution took place instead of on the axle. With respect to the fish-joint which Mr. Dennet had claimed for Mr. Jowett, he believed there were a great many persons who laid claim to its invention. He knew that Mr. Adams put in claims for that many years ago, and he knew many others who also laid claim to a mode of fishing rails. He had no doubt that by Mr. Jowett's plan a certain amount of elasticity would be obtained, but Mr. Dennet had not stated whether the sleepers themselves would not be weakened by that arrangement.

Mr. Dennet replied—Not at all; quite the reverse. He would add that he did not claim for Mr. Jowett the invention of the fish-joint, but that particular form of fish-joint to which he had referred. It was different from that of Mr. Adams's, the ingenuity of which he did not wish to detract from.

The Chairman said he remembered a system of fixing the rails into timber as long as twelve years ago—not exactly like that shown to-night, but very similar to it, which was tried on the South-Eastern line near London-bridge.

Mr. Dennet said that Jowett's plan of fixing the rail in the wood was different from that alluded to by the Chairman, and was quite new. In the plan referred to by the Chairman the metal was embodied in the wood.

The Chairman then proceeded to say that these various proposals of Mr. Adams undoubtedly tended to diminish a very great amount of the friction which took place in railway trains: and any diminution of those forces would practically be a diminution of the cost of working, and an increase of dividends to the shareholders; and he trusted it would eventually lead to a diminution of the fares charged to the public. In that respect these matters were of the greatest public importance, and he was sure the meeting would readily accord their thanks to Mr. Adams for his very able paper.

The vote of thanks having been passed,

Mr. Adams said he took no credit to himself for the invention of the fish-joint, for five hundred different people, setting down to patch a rail as he did in the first instance, would probably have come to the same conclusion, only he happened to be the first to place such an invention on record. He never considered the fish as used was good, and he set himself to devise what he thought was a good fish on the plan he had laid before them. With regard to wheels, he did not enter into the question of which was the best structure, but merely alluded to the disc wheel as a form to which he wished the elastic tires to be applied; but the spring tire was applicable to all kinds of wheels, whether on common roads or on rails, and the section on the wall showed a mode of applying spring tires to road locomotives. The subject was too extensive to be dealt with in one paper, and he would deal with other branches in the paper which was to follow. He wished, however, to impress upon the meeting that it was perfectly practicable to make engines to go round curves of a radius of $1\frac{1}{2}$ chain, and he claimed a plan of distributing the weight upon all the wheels of an engine instead of principally upon the driving wheels. As to the mode of fixing the rails in the sleepers, there had been several plans proposed of cutting the sleepers, but they were all open to the objection that by cutting into the material of the sleeper its strength was impaired. If a sleeper with the ordinary chair required five inches in depth, then when it was cut away to the depth of three inches, it ought to be eight inches in depth in order to make up for the part cut away.

Proceedings of Institutions.

WORCESTERSHIRE UNION OF EDUCATIONAL INSTITUTES.—The annual meeting of this body was held on Wednesday, the 16th November, at Droitwich. The proceedings consisted of a morning meeting for business and discussion, a public dinner, under the presidency of Lord Lyttelton, a *soirée*, and evening meeting. The evening meeting was held at six o'clock, and was attended numerously, many ladies being present. The chair was occupied by Sir John Pakington, Bart., K.C.B., M.P.; and there were present on the platform Lord Lyttelton, Lord Robert Cecil, M.P., the Hon. and Rev. W. Douglas, the Rev. Canon Melville, Rev. Dr. Collis, Rev. W. Walters, Mr. H. F. Vernon, M.P., Mr. J. S. Pakington, the Mayor of Droitwich (Dr. Roden), Mr. J. S. Isaac, and others. The chairman, in opening the proceedings, said he was delighted to bid welcome, in the name of the Droitwich Institute, and of the whole neighbourhood, to the representatives of the different Institutes forming the union. He believed that there was no nobler object of domestic policy in this country than the endeavour to promote everything which could tend to improve the physical or the intellectual condition of that vast body of their fellow countrymen who lived and maintained their families by their own exertions and their own industry. The more they elevated the character of the working man, the more they increased his respectability and comfort. The more closely they could draw together those various classes of which English society was composed, and bind them closely to each other by feelings of mutual respect, mutual dependence, and mutual good feeling, the greater would be the aggregate of the prosperity and the happiness and the welfare of this nation. These were considerations which induced him to attach the greatest possible importance to meetings of that kind. They were assembled there essentially and specially to promote a great public object, which, in his judgment and belief, referred essentially and directly to the welfare of those industrious thousands by whom they were surrounded, but their immediate object related to the intellectual improvement of those classes. He here wished to say, in the most distinct and emphatic manner, that he would not ask them to support that union, he would not ask them to give to the Institutes separately their best aid, if he did not in his conscience believe that they were calculated to promote clear, distinct, practical benefits. Looking to the manner in which these Institutes promoted the interests of the working man, they did so in two distinct and most important respects. The first he would advert to was this: that they sought by these Institutes to give to the industrious working man a resort where, in his leisure hours, he might enjoy innocent and useful recreation, instead of being driven to the dangerous and seductive enjoyments which were offered by the public-house. If any publicans were present they would forgive him. He did not wish to interfere with their legitimate business, but what he wanted to say was, that the working man should be able to resort to an Institution where he might obtain innocent society and innocent recreation and amusement, without the danger of being enticed into habits which must be destructive of his own welfare and of the welfare of his family. The next object was of immense importance—that they might, by resorting to these Institutes, avail themselves of the educational classes which always ought to be carried on in connection with them. He was glad to find that nearly all of the 20 or 30 Institutes in the union had educational classes in connection with them, and that their progress had been steady and rapid since 1858. Sir John concluded by expressing his belief in the good which was effected by the organisation and system which this meeting of the union every year enabled them to carry out.—The secretary having read the report, Lord Robert Cecil moved—"That the continual education of the industrial classes after the age of childhood was one of the most important aids to national well-being, and, as such, deserves the best attention of statesmen and philanthropists." The Rev. D. Melville seconded the resolution, which was carried. Lord Lyttelton and other gentlemen afterwards addressed the meeting.

NORTH LONDON WORKING CLASSES INDUSTRIAL EXHIBITION.

The following is the report of the adjudicators:—

The duties undertaken by the adjudicators, at the request of the committee, were of great delicacy; and the experience acquired by them in the Exhibitions of 1851 and 1862 in London, and of 1855 in Paris, helped them less than might have been expected, as the different circumstances under which the articles exhibited had been produced and collected rendered any previous standards of comparison inapplicable. The present Industrial Exhibition, like that recently held at Lambeth, has but little in common with those great undertakings. On those occasions considerable time was given to the public for preparation; temptations to exhibit were freely offered in the shape of medals and other prizes; for a prominent manufacturer to fail to be represented, was to "go to the rear" in the great industrial race; the opportunities for comparison and competition were beyond all precedent; capital had ample scope for profitable investment in productions suitable for sale in the markets of the world; and above all, these Exhibitions were inaugurated by the patronage and presence of the most illustrious personages of this and other countries—by splendid pageantry and ceremonial, and by profuse expenditure in decoration, music, and other attractive accessories. "The North London Working Classes Industrial Exhibition," from its necessarily limited nature and modest pretensions, can lay claim to no such advantages; it is emphatically a Workman's Exhibition.

The original idea, the organisation, and the successful results, are solely due to working men as exhibitors, committee-men, and honorary secretaries. They have declined many tenders of pecuniary assistance from the wealthy, but have not hesitated gratefully to accept spontaneous offers of guarantee from well-wishers to the experiment, in the full confidence, now happily more than realised, that the necessity for having recourse to them would not arise.

The response on the part of the workmen to the invitation to exhibit was enthusiastic, and resulted in a contribution of several thousand miscellaneous articles, upon the merits of which the Adjudicators have had to form a judgment. In making the awards, the merits of professional work have not been brought into competition with those of that produced by amateurs; but the Adjudicators have endeavoured, in all cases, to take into reasonable consideration the circumstances under which the articles have been elaborated. As regards professional workmanship, much of it is highly creditable to the producers, especially considering the nearly extemporised circumstances under which their skill and taste are exhibited in so many forms. As regards the amateur contributions, the Adjudicators are of opinion that, taking into consideration the small amount of leisure, and, in many cases, the inferior appliances and limited means at the disposal of the producers, the articles exhibited show in many instances a high, and in some instances an extraordinary degree of merit. It has afforded sincere pleasure to note the elevating character of very many evidences of the substitution of intellectual cultivation, in the workman's hours of relaxation from his daily and appointed toil, for the grosser stimulants of the senses. Such illustrations of successful aspiration are regarded as elements of even greater hope for the future than they are of congratulation for the past.

The adjudicators cannot close this Report without

tendering their warmest congratulations to the Committee and others who have organised in their district this most successful social experiment, and can only regret that the limited time for which the Hall was available has rendered it necessary to close the Exhibition whilst the continued attendance of very large numbers seemed to show that the interest excited was undiminished.

(Signed) THOMAS WINKWORTH,
D. K. CLARK, C.E.,
GEO. F. WILSON,
P. LE NEVE FOSTER,
J. A. NICHOLAY,
PETER GRAHAM,
M. DIGBY WYATT.

7th November, 1864.

WEST LONDON WORKING CLASSES' INDUSTRIAL EXHIBITION.

On Monday evening, the 21st November, a public meeting was held in Castle-street school-room. Mr. R. M. Morrell presided, and, upon opening the meeting, said he believed that the objects of industrial exhibitions were now so generally known that it would require but little explanation from him. He felt confident that much good had arisen from those exhibitions that had been already held, and as the north and south of London had successfully held their exhibitions, he (Mr. Morrell) contended that it would be an utter disgrace to the working men of the western division of London if they did not make as good, if not a better, exhibition than those previously held. After reading the preliminary prospectus and commenting upon the names of the several gentlemen who have already consented to be parties to the guarantee fund, he left the proceedings entirely in the hands of the meeting. It was then moved by Messrs. Howe and J. B. Bailey, "That this meeting pledges itself to support the Industrial Exhibition for the borough of Marylebone that is now in course of formation all that lies in its power." After which Mr. Tucker proposed, and Mr. C. Hooper seconded, "That a district committee be formed from this meeting for the purpose of making the movement known and obtaining patrons from members of this district," which was also carried. A working man then asked whether the committee of the exhibition would guarantee the registration of any new invention that would be exhibited. The chairman, in answering, said that as the committees of those exhibitions which had already been held (he believed) did not feel themselves safe in promising to guarantee a registration to any exhibitors of a new invention, he thought his committee would take the same view of the question, but he would accept the feeling expressed by the meeting as an instruction for him to put himself in correspondence with the committees of the past exhibitions, and would consult a member of the Government as to the desirability of introducing a short Act of Parliament which should give the desired guarantee of security to all future exhibitors. The assistant secretary, Mr. S. A. Barrows, then said that he thought it would be unfair to the parties to the guarantee fund for the committee to promise to guarantee registrations, at all events for the first exhibition, but as it was decided to invest any surplus that might arise from this exhibition in the names of trustees for the purpose of defraying the expenses of any future exhibition that might be held in the west of London, he thought that if it should be decided that the committee could not guarantee registration on this occasion, they might be able to do so on the next. Mr. C. Hooper then asked what prizes it was intended to award. The chairman said that he was extremely sorry that the committee did not feel themselves in a position to promise pecuniary prizes, but undoubtedly if this exhibition proved as successful as the north of London, they would distribute part of the returns in prizes, and invest the surplus. Mr. Foxwell, a working man, addressed the meeting at some length on the subject of the guarantee fund. He said that he would be sorry to object to the upper classes assisting the projectors in so excellent a movement, but he considered that working men themselves should figure largely in the guarantee fund. He should like to see every working man in the west of London, and indeed all others who take any interest in such a movement, guarantee some sum, if only a shilling, but he also hoped that although the committee might have many names on their guarantee fund, there would be no necessity to call upon one of them. He then moved the following resolution, which was seconded by Mr. Haswell, and carried amid loud cheering:—"That working men present pledge themselves to support the guarantee fund of themselves as far as lies in their power." The assistant secretary then received the names of the working men present for sums varying from 10s. to 2s. 6d. A district committee of eight, with power to add to their number, was then formed, and after a vote of thanks to Mr. Charles Marshall for the use of the room, the meeting concluded with a vote of thanks to the chairman.

Manufactures.

Textile Manufactures.—From an official account just published by the Minister of Agriculture and Commerce at Turin, the raw silk brought into the markets of Italy during the last year amounted to upwards of 4,000,000lbs., representing a value of about 4½ millions sterling. The quantity of cotton spun in Italy was above 60 million pounds weight, more that half of which belonged to Lombardy. The quantity of flax sent during the last ten months to the port of Archangel alone from the province of Vologda was about 18 million pounds weight. There are 49 cloth-manufactories at Moscow, producing £1,663,000 worth of cloth. There are besides 90 manufactories of thin woollen stuffs, which have in a great measure superseded cotton ones, owing to the scarcity of that material.

Lenoir's Gas Engine.—This engine, a notice of which was given in the *Journal*, Vol. XII., p. 673, is being largely used in Paris. It is said there are not less than five hundred now at work in that city for various purposes, and amongst others it is employed by builders for hoisting their materials. The one which was put up in Birmingham a short time since by Mr. Wiley at his factory is reported a success. A manufactory of these engines has just been established at Reading.

Commerce.

External Trade of the Country.—It is well known that the trade of this country has been advancing of late years to an enormous extent, notwithstanding the American war and the unsettled state of European politics. This advance is shown in a striking manner when the Board of Trade returns for the past ten years are compared. The total increase in the trade of the country in that period is nearly £177,000,000, which is made up as follows:—

Imports, 1854	£152,389,000
,, 1863	248,981,000
Exports, 1854, British produce	£97,184,000
,, ,, Foreign and colonial	18,637,000
Total	£115,821,000
,, 1863, British produce	146,489,000
,, ,, Foreign and colonial	49,485,000
Total	£195,974,000

The total imports and exports of the country, which

were £268,210,000 in 1854, had risen to £444,955,000 in 1863. The increase in importation (£96,502,000) is enormous, but is not of such importance as the figures would at first indicate, since a large proportion is again exported, this country serving merely as an entrepôt, but it affords a very valuable index to the prosperity of the country when we find that it has been followed by proportionately increased consumption. The quantities of corn and flour, the most important articles of consumption, have nearly doubled in the ten years, whilst cotton, 40,000 tons of which came here in 1854, rose in 1860 to 60,000 tons, but it declined to 30,000 tons in 1863, in consequence of the American war. The consumption of wine has increased about twenty per cent.; tobacco to about the same extent; tea, currants, raisins, and other dried fruits have greatly increased; whilst coffee and cocoa have alone fallen off. Sugar has, considering the increased prosperity of all classes, virtually stood still.

Banking in Frankfort.—The banking business is the most important in Frankfort; indeed, the city possesses nearly as many banking firms as there are persons employed in banking and gold dealing in Bremen, and absolutely more than the number of such establishments in Berlin. There are 99 directors, or heads of banks, in Frankfort, who employ 383 servants, 203 clerks, 150 apprentices, and 144 travellers. The banking business sustains directly nearly 2,000 persons in all. There are also 183 money-changers.

Grapes from the United States.—Fresh-grown grapes have been shipped from New York to this country, by way of experiment, to Messrs. Keeling and Hunt, of London.

Obituary.

M. Achille Lefevre, a French engraver, who has reproduced the principal works of Raphael and Corregio, and whose "Antiope," ordered by the Imperial Government, was exhibited the other in the Palais de l'Industrie, was carried off rather suddenly a few days since. His death is a severe loss to art.

Another vacancy has occurred among the Royal Academicians by the death of David Roberts, which occurred suddenly on Friday evening, the 25th of November. He had just completed the 68th year of his age, having been born in the neighbourhood of Edinburgh, on the 24th of October, 1796. While a boy he was apprenticed to a house painter in Edinburgh, and during that time admitted to the Trustees' Academy, in which Wilkie, Allan, and many other Scottish artists were reared, but only attended once. Coming to London, we hear of David Roberts as engaged as a scene painter at Drury-lane Theatre, where he commenced his career in 1822, along with the firm friend of his early and later years, Clarkson Stanfield. Shortly after he and other artists instituted the Society of British Artists, of which he was for some time vice-president. He first exhibited at the Royal Academy in 1826, when he sent a view of Rouen Cathedral, and in the following year he exhibited one of St. Germain's, at Amiens. His name does not, however, appear in the Academy catalogue again until 1830. After another interval, in 1835-6-7 he contributed views of Spanish antiquities, and in 1839 he was elected an associate, attaining the full honours of the Academy in 1841. Roberts was always a great traveller, and he has been for the last quarter of a century a very copious contributor of views of Egyptian, Belgian, Spanish, and Scottish architecture and scenery, as well as subjects from Venice, Vienna, and other Continental capitals. His "Inauguration of the (first) Great Exhibition" was a commission from her Majesty. We look back with wonder on the production of works of such quality—"The Baalbec," "The Jerusalem from the Mount of Olives," "The Temple of the Sun at Baalbec," which our readers will remember at the International Exhibition of 1862, and "The Destruction of Jerusalem." Among the principal works illustrated by him were Sir Edward Bulwer Lytton's "Pilgrims of the Rhine" and the "Landscape Annual" for 1835-6-7-8, embracing views principally in Spain Morocco, Castile, Andalusia, and Biscay. The best known of all his works is his "Sketches in the Holy Land, Syria, Idumæa, Arabia, Egypt, and Nubia," in four volumes folio, with letterpress by Dr. Croly—one of the largest and most important works of the kind ever published in this country. Very many of Roberts's best paintings have been engraved, and to this fact is due some portion of the wide spread reputation of his exquisitely gifted and graceful pencil. Mr. Roberts took an active part in the proceedings of the Society of Arts connected with its exhibition of living artists. Mr. Roberts was married, and has left surviving issue. In private life he was sincerely and deservedly beloved, both within and without the profession of which he was so distinguished a member. He was elected a member of the Society of Arts in 1847.

Notes.

British Museum.—A notice has been posted in the reading-room of the British Museum, intimating that a refreshment-room has been provided, under certain regulations, for the exclusive use of readers and students. This concession will doubtless be appreciated by many who have for a length of time suffered great inconvenience by being compelled to rise from their studies and leave the institution to obtain refreshments.

Lighting Moscow with Gas.—In the Hague *Dagblad*, it is stated, that M. N. D. Goldsmid, of this town, has acquired a concession for lighting Moscow with gas. It is granted for 30 years, and gives him an exclusive privilege of laying gas pipes and other fittings in the streets of Moscow for that time. The number of public gas lamps is to be 10,000, and private buildings will require 150,000 lights. Moscow has more than 400 hotels and 3,000 coffee-houses, inns, and ginshops; these are open all night, as the inhabitants seldom go to bed before 2 or 3 in the morning, and in the winter scarcely ever remain in the street. The number of shops and magazines is four times greater than in St Petersburg. According to the terms of the contract, the gas will cost for the private lighting 5 roubles, or 9fr. 50c. per 1,000 cubic feet (English measure). The concession will require colossal gasworks, but there can be no doubt it promises in a financial point of view good results.

New Laboratory for Dr. Hofmann at Berlin.—The *Moniteur Scientifique* announces that the Prussian government has bought a plot of ground at Berlin on which to build a large laboratory for Dr. Hofmann, who will leave London soon and commence his university course of lectures there after next Easter. Dr. Hofmann, however, will, when the laboratory at Bonn is finished, definitively take up his residence in that city. The first stone was laid with much ceremony on September 16.

Co-operation in Paris.—A number of working coppersmiths of Paris are now forming a society for the foundation of a firm to be conducted by the members themselves in common. A capital of 25,000f. has already been raised by 250 shares of 100f. each, subscribed by 208 workmen. The intention of the association is to gradually unite as many members as possible of the trade as associates in workshops to be successively added to the establishment.

Fire Arms.—The official life of the Enfield rifle is 12 years, and during this period it is calculated to fire about one thousand rounds, as each man is allowed 80 rounds a year. At the end of 12 years the man is entitled to a new rifle, but as many of the volunteers who practice assiduously at shooting, and fire more than a thousand rounds in a year, the Enfield in their hands cannot be relied on after a twelvemonth's use. It is, in fact, worn out at the end of that time.

Correspondence.

Mr. Fairbairn's Paper.—Sir,—In your report of the discussion following Mr. Fairbairn's lecture on iron, you have made me appear to advocate the use of steel armour-plates. This is not correct. I distinctly stated that hitherto all efforts to produce efficient steel armour had failed; but that mild steel was admirably adapted for the framing, beams, and *internal* plating of men-of-war. Moreover, that it was only a question of the application of power to roll beams and frame-girders in one solid length, instead of building them up, by rivetting a system of T and angle bars; and that a better material, applied in the best form, would enable us to save from 400 to 600 tons in the weight of our armour-cased frigates. Apologising for this short intrusion,

I am, &c., F. A. Rochussen.

9, Friday-street, Cheapside, London, E.C., 26th November, 1864.

Fire-proof Construction.—Sir,—In my notes on the fire-proof construction of dwellings published in *Journal* No. 619, I find that I have omitted to mention amongst brick arches a plan designed by Mr. F. H. Groves, of arching in brickwork on the fan vault principle. The rings, commencing from each of the piers, proceed concentrically on plan, till it meets the others, when a circular opening may be left in the centre for light, or closed with herring-bone key, as circumstances require, or, where more light is required, panels may be formed as shown in model. This construction entirely obviates the necessity of thick walls or iron ties, as the thrust is concentrated on the four angles of support. The space occupying little more than would be required for a wood floor with girders and ceiling joists, Mr. Groves estimates that a half-brick arch will suffice for spans from 10 to 12 feet, one brick from 12 to 20 feet, and one and half brick from 20 to 40 feet. He has put his principle to the test by having a model erected in the yard of Mr. Allen, builder, of Great Smith-street, Westminster, which has stood for twelve months without showing the least defect. The model is 20 feet long by 11 feet wide, and consists of two compartments—one illustrating a floor and roof and the other a roof with ribs and spaces or panels left open for light. The floor has been tested with a permanent weight of two tons. The cost of this construction, in a stable and warehouse erected on this principle, near the Strand, was as follows:—Revolving centering for segmental flat arches, 30s. per square; for elliptical arches, 35s.; brick arches, laid in revolving rings, for nine arches, £1 14s. extra; 14 arches, £1 2s. 6d. extra per rod on the price of brickwork for walls. Taking the above prices as a basis of calculation, the cost of a square, or 100 feet super., for a span of 14 feet, would be nearly £7 10s., including levelling up the floor and tiling, and plastering the underside. Further particulars as regards this construction can be seen by reference to the *Builder* journal, of May 4th, 1861, and May 7th, 1864. A small model can also be seen at Mr. Twining's Museum at Twickenham. I am, &c.,

Henry M. Eyton.

Ships and Guns.—Sir,—Mr. Fairbairn concludes his remarks following the discussion of his paper, read at the Society of Arts on the 23rd ult., with these observations:—"On the question of armour plates he would say, if they were to have 300 or 400-pounder guns, it was a question with him whether it would not be better to be without armour plates altogether, and let the shots go right through, because they were limited to a certain thickness and weight of plates; and if they were to cover vessels from stem to stern, and five feet below the water-line, they would not be able to carry plates that would resist large guns. If that description of artillery was used his opinion was they would have a more secure and better navy without the iron plates than with them." Why are we "limited to a certain thickness and weight of plates?" and why also are the ships unable to carry plates that would resist those large guns, if the vessels are covered from "stem to stern and five feet below the water-line?" If the Admiralty would take my humble advice and put the *Warrior*, now about to undergo certain alterations, into a dock, after removing the machinery, boilers, internal fittings and lower masts, and cut her into two—fore and aft—up the middle and separate the two sides of the ship so severed some 18 to 20 feet asunder, and convert her into a double-ended ship, those gentlemen who are inclined to despond over the present state of matters in connection with iron-clad ships would then see some cause for taking fresh courage and go forward instead of backward. The *Warrior*, as she now is, is a very long ship for one of those liners which have got to do the heavy work of a sea fight. She is 380 feet in length, and only 58½ feet outside beam, drawing 26 feet water ready for sea. She is a vessel having what we may call a sharp bottom, her midship section showing a good rise of floor and a round easy bilge, with fine long tapered ends. This form of bottom tends to crankness, and who will venture to say the *Warrior*, carrying some 1,000 tons of solid iron on her topsides, is not crank and liable to dangerous rolling in bad weather? By altering this ship, as proposed, into a double ended ship, we shall add some 30 to 40 per cent., at least, to her present displacement; she will be stiff and able to carry, at all times and under all conditions of weather, the heaviest load in the shape of armour and guns that the progressive state of the gun question may demand. Rolling, pitching, and scudding or plunging, as now experienced in the case of our iron clads, will not exist. She would be able to meet or attack a foe when no other iron clad could attempt it; in fact, she would be just such a ship as we now require to take the place of the old wooden three deck liners now becoming obsolete. Our shores need protection in winter weather as well as summer; but we have no ships as yet adapted so well to perform this service as the old wooden liners and frigates. We have got to apply the double propeller principle to these large ships of the navy, and also the double rudder; they want something more than a single screw or a single rudder to govern their motions. And ships of this class, having plenty of room upon their upper deck, should have a battery amidships carried upon this deck over the engines, and boilers protected with plating or other armour, to protect it against vertical fire as well as horizontal fire, which battery could be armed with six or eight heavy guns upon turn-tables, the extremities of this deck having turrets. We should then have a most formidable ship, not intended to run away from the enemy, but to stand her ground, and calculated to receive him and return his compliments most vigorously. There are no difficulties in our way of cutting the *Warrior* or any other iron-clad ship, which is found to be too narrow, into two parts, fore and aft, and separating them any required distance apart, which may not be overcome; and this is certainly the best way to spend our money at the present time, to get the most for it—far more wisdom in it than continuing to build ships to carry permanent armour after the present style of model. We know as much as we need to know at present in regard to "the application of iron to the purposes of naval construction;" but we evidently are far astray in the models and proportions of our ships, propellers, and steering apparatus, and other matters bearing upon this part of the subject of armour-clad ships-of-war. Mr. John Hawkshaw's remarks on the question of armour are worth particular attention.—I am, &c., John Kennedy.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Entomological, 7.
British Architects, 8.
Medical, 8. Dr. Habershon, "On the Constitutional Character and Modifications of Skin Diseases."
Royal Inst., 2. General Monthly Meeting.

Tues. ...Civil Engineers, 8. 1. Discussion upon Mr. Clark's paper "On the Great Grimsby Docks." 2. Mr. Joseph Taylor, "The River Tees, and the Works upon it connected with the Navigation."
Photographic, 8.
Anthropological, 8. 1. Mr. Samuel Laing, "On the Contents of a Kist from Keiss, N.B." 2. Mr. George E. Roberts, "On the Discovery of a large Kistvaen in the Muckle Heog, in the Island of Unst, Shetland," with Notes on the Human Remains, by Mr. C. Carter Blake. 3. Dr. Bird, "On Tumuli from Cheltenham." 4. Mr. George E. Roberts, "On some Prehistoric Hut Circles." 5. Dr. T. W. Smart, "On some Ancient Skulls." Communicated by the President.
Geologists' Association. Mr. C. Tomlinson, "Chisel Bank."

Wed. ...Society of Arts, 8. Mr. Bridges Adams, "On the Construction, Retardation, Safety, and Police of Railway Trains."
Medical, 8. Dr. Thudichum, "Lettsonian Lectures."
Geological, 8. 1. Dr. James Hector, "On the Geology of Otago, New Zealand." 2. Mr. Julius Haast, "On the Excavation of Deep Lake Basins in Hard Rocks in the Southern Alps of New Zealand." 3. Mr. Julius Haast, "Notes to a Sketch Map of the Province of Canterbury, New Zealand, showing the Glaciation during the Pleistocene and Recent Times." 4. Sir R. I. Murchison, "Notes on Dr. Haast's papers."
Pharmaceutical, 8.
R. Society of Literature, 4½.

Thurs....Royal, 8½.
Antiquaries, 8.
R. Society Club, 6.

Fri........Astronomical, 8.

Sat........R. Botanic, 3¾.

Patents.

From Commissioners of Patents Journal, November 25th.

Grants of Provisional Protection.

Accidental fire, apparatus for giving alarm in case of—2500—W. Gilbert, E. Cooper, and G. R. Webster.
Boots, &c., apparatus for stamping—2736—A. J. Fraser.
Boots and shoes—2774—J. Okey.
Bottles, stopper for—2787—F. Lane.
Boxes, packing for stuffing—2756—R. A. Brooman.
Card covering—2835—J. Farrar and J. Farrar.
Carriage doors, attaching the inside handles of—2728—E. J. Harrison.
Casting, making moulds for—2807—J. Kinniburgh.
Cement—2801—W. L. Lees.
Centrifugal pumps, portable—2761—C. T. Burgess.
Cigars—2730—H. B. Harris and J. P. Thomson.
Corn, apparatus for grinding—2768—J. Hurt and H. Tonge.
Crinoline skirts 2849—J. N. Smith.
Drains, &c., construction of traps for—2782—S. C. Reed.
Files, &c., machinery for grinding—2859—R. Allinson and H. Lea.
Fires, extinguishing—2595—C. Brothers.
Fire-arms, breech-loading—2855—T. Restell.
Fog signals, apparatus for producing—2813—E. Richardson.
Food, cooking—2732—F. L. Bauwens.
Forks and spoons, construction of—2805—J. Cockshott.
Furnaces, blowing—2758—J. M. Stanley and J. Stanley.
Gas, regulating the supply of—2827—C. Esplin.
Gases, apparatus for generating combustible—2734—F. Yates.
Grease, obtaining from wash waters—2614—G. E. Donisthorpe.
Gun cotton, manufacturing compounds of - 2675—A. Parkes.
Hats, manufacture of—2851—C. Vero.
Hats, &c., manufacture of—2720 —E. T. Hughes.
Hydraulic presses—2754 —A. Steven.
Inkstands—2722—E. G. Brewer.
Jute, preparation of—2861—F. C. Parker.
Ladies' dresses—2833—G. Needham.
Lamps, means of supporting glasses, &c.—2586—A. Clavel.
Lead, extracting silver from—2776—A. Moreau.
Liquids, apparatus for drawing off—2766—R. Rimmer.
Looms for weaving—2829—P. A. Le Comte de Fontainemoreau.
Metal blanks, manufacture of—2729—J. Dodge.
Metals, machinery for punching, &c.—2726—W. Bayliss.
Motive power by capillary attraction—2648—J. E. F. Ludeke and D. Wilckens.
Mouldings, &c., cutting wood into—2867—H. Grafton.
Oakum, manufacture of—2752—D. Cullen.
Oil lamps, construction of—2740—J. Sullivan.
Paper, embossing or indenting—2742—J. R. Crompton.
Pipes, &c., moulds for casting—2845—G. Robinson.
Pottery, manufacture of—2795—T. L. Boote and R. Boote.
Printing machines—2750—G. Duncan.
Railway carriage, lubricating axles of—2837—J. M. Hart and R. Purkis.
Railway bars, &c., construction of—2747—J. D. Young.
Railways, permanent way of—2795—H. Brockett.
Railway signals, securing the levers used to work—2857—R. Holiday.
Railway trains, safety apparatus applicable to—2724—J. G. Rowe.
Roadways, machinery for rolling—2527—M. Henry.
Rotary engines—2644—W. Clark.
Saccharine matters, preparing—2538—R. Wright.
Scarfs—2847—G. C. Attree.
Screw driving, &c., tools for—2731—F. S. Gilbert.
Screw propellors, method of raising—2771—W. K. Hall.
Sewing machines—2817—J. Keats and W. S. Clark.
Ships' sails, fitting—2663—W. Congalton.
Shutters, rolling and revolving—2865—H. Grafton.
Sound, apparatus for softening and deadening—2809—F. Fearon.
Steam, &c., obtaining motive power from—2738—M. P. W. Boulton.
Steel and iron, manufacture of—2839—J. Firth.
Straw hats, strengthening the brims of—2778—J. D. Welch and A. P. Welch.
Sulphuric acid, manufacturing—2607—A. Reynolds.
Thrashing machines—2718—S. Davies.
Tramways, securing—2612—G. E. Donisthorpe.
Washing machines—2815—J Thorne.
Whips, &c.—2823—C. S. Cadman.
Wool, &c., machinery for combing—2642—G. E. Donisthorpe.
Wool, &c., sprinkling liquids over—2744—M. J. Roberts.
Yarns, preparing wool and hair for—2825—H. W. Ripley.

Invention with Complete Specification Filed.

Brick and tile making machinery—2879—W. Snell.
Ornamental chains, manufacture of—2873—G. T. Bousfield.

Patents Sealed.

1299. W. Law.	1353. J. Platt and E. Hartley.
1315. J. Eastwood.	1357. G. E. Dering.
1316. J. Whitley & D. F. Bower.	1358. C. R. Humphrey and J. Hasler.
1326 J. Dichson.	1360. H. Ambler.
1328. A. Etienne.	1371. E. Myers.
1335. T. Drew.	1401. J. Napier.
1337. W. Halse.	1405. W. H. Preece.
1338. C. Hall.	1416. J. Beck.
1339. J. Huggett.	1432. R. Oldridge.
1344. G. Haseltine.	1436. M. Henry.
1347. R. A. Brooman.	1919. F. W. Bossert.
1350. J. M. Stanley & J. Stanley.	
1352. W. Firth and S. Firth.	

From Commissioners of Patents Journal, November 29th.

Patents Sealed.

1355. R. E. Donovan and R. Bowles.	1407. T. Aveling and T. Lake.
1363. L. Kinnings, G. Gibbs, and W. T. Edwards.	1413. W. Clark.
1369. R. Threlfall and R. W. Pitfield.	1425. T. Richards.
1370. W. H. Mellor.	1448. R. Hall and J. Chambers.
1372. R. A. Brooman.	1470. B. Fothergill.
1373. R. A. Brooman.	15 1. J. Hodges.
1374. W. Clark.	1559. T. P. Saville.
1382. A. H. Williams.	1594. B. Nicoll.
1385. T. Holden.	1598. W. E. Newton.
1388. W. Houghton, G. Burrows, and C. Oldroyd.	1635. J. Combe.
	2060. H. Parkes.
	2212. L. F. Goodbody.
	2269. C. Attwood.

Patents on which the Stamp Duty of £50 has been Paid.

2958. J. Willcox.	2955. J. Ronald.
2973. G. Bottomley.	2960. J. H. Johnson.
2975. W. Firth and R. Ridley.	2953. J. Macintosh.
2977. G. E. Donisthorpe, W. Firth, and R. Ridley.	2995. W. Rowan.
3001. S. A. Carpenter.	3009. T. Ellis.
3005. J. D'Adhemar de Labaume.	2979. J. Standfield.
3015. E. Tyer.	2980. F. A. Calvert.
3096. T. Higgins.	2981. F. F. Dumarchey.
	2997. H. Wilde.

Patents on which the Stamp Duty of £100 has been paid.

2930. W. McFarlane.	2996. A. Parkes and H. Parkes.
2978. J. Howard.	2945. A. Martin and J. Martin.
2929. S. Riley.	2976. D. K. Clark.
2958. S. B. Wright and H. T. Green.	2995. J. Francis and C. Manby.

Registered Designs.

Artificial Teat—Nov. 21—4673—S. Maw and Son, 11, Aldersgate-street, City.
Improved Side Light—Nov. 24—4674—Marsden, Brothers, Liverpool.
Button—Nov. 30—4675—William Nokes, Birmingham.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, DECEMBER 9, 1864. [No. 629. VOL. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

DEC. 14.—"On the Recent Progress and Present State of Industry in Ireland; and the Dublin International Exhibition of 1865." By Sir ROBERT KANE, F.R.S. On this occasion Lord DUFFERIN will preside.

DEC. 21.—The Articles sent in Competition for the Art-Workmanship Prizes will be Exhibited, and a Report in connection therewith will be read.

CANTOR LECTURES.

"ON THE REPRODUCTION OF NATURAL FORMS BY ART AND MANUFACTURE." By B. WATERHOUSE HAWKINS, ESQ., F.G.S., F.L.S.

DEC. 12TH.—LECTURE I.—INTRODUCTORY: — On the nature and probable influence of museums of natural history and art collections, and their effect on the public mind and taste. (Illustrated.)

DEC. 19.—LECTURE II.—Demonstrations of the unity of plan in the external forms of animals, the just appreciation of which facilitates the work of the artistic producer, and adds to the enjoyment of the intelligent possessor of works of art.

JAN. 16TH, 1865.—LECTURE III.—On the varieties of artistic treatment of the forms of animal and vegetable life—pictorial representation; conventional ornamental, allegorical, and symbolic combinations of animal forms.

JAN. 23RD.—LECTURE IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

JAN. 30TH.—LECTURE V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. A set of tickets for this purpose has been sent to every member.

ART-WORKMANSHIP PRIZES.

Articles (ninety-six in number) sent in competition for the Art-Workmanship Prizes, have been received from seventy-three competitors, and will be arranged for exhibition in the Society's rooms on and after Wednesday, the 21st instant.

STETTIN GENERAL EXHIBITION OF INDUSTRY.

The Board of Trade have sent to the Council the following information from H.M. Consul at Stettin, in reference to this Exhibition :—

The exhibition is under the patronage of H.R.H. the Crown Prince of Prussia, and will open, simultaneously with the exhibition of agricultural products, in May, 1865. The following committee, consisting of Messrs. Dr. Delbrück, Director of Cement-works; Hobrecht, City Architect; G. Müller, Belgian Consul; R. Müller, Director of Sugar-works; Th. von der Nahmer, bookseller; Rahm, Councillor of Commerce, President of the Chamber of Commerce; Dr. Scheibler, chemist; Stein, Director of the Berlin Stettin Railway, appointed by the Polytechnic Society of Stettin, has been entrusted with the management of the exhibition and has issued the following conditions:—1. Exhibitors of all nations and products of all countries are admitted. The committee is, however, authorised to refuse articles of inferior quality or minor importance. 2. The exhibition will be opened on the 15th of May and closed at the end of June. 3. The exhibitors are requested to forward a specification of the articles which they intend to exhibit, as well as of the space required for them, to the undersigned committee before the 1st of January, 1865. 4. In order to defray part of the expenses a charge will be made, the amount of which will be calculated according to the value of, and the space occupied by, the exhibited article. In respect to space, the charge per square foot, either of the floor or walls in the building itself, will be $2\frac{1}{2}$ sgr.* In respect to value, for articles under 49 dollars, a charge of 10 sgr.;

* 10 sgr. equal to 1 shilling. 1 dollar equal to 3 shillings.

for articles from 50 to 149 dollars inclusive, 20 sgr.; for articles from 150 dollars and upwards, ½ per cent. of the value. Articles of considerable size, as machines, carriages, &c., which will be exhibited in the side-wings, pay but one-half of the above mentioned charge. For instance, for an article worth 25 dollars and occupying 6 square feet, 25 sgr. will be charged, viz., 10 sgr. value and 15 sgr. space. The charge for an article worth 300 dollars and occupying 16 square feet, would be 2 dollars, 25 sgr., viz., 1 dollar 15 sgr. value, and 1 dollar 10 sgr. space. For machines worth 2,000 dollars and occupying 80 square feet, which will be exhibited in the side-wings of the building, the charge would be 8 dollars 10 sgr., viz., 5 dollars value and 3 dollars and 10 sgr. space. (For every fraction of a hundred the full per-centage will be reckoned. Every exhibitor will only have to pay the charge on the sum total of the value of all the articles exhibited by him.) 5. As commission-agents for receiving, unpacking and repacking goods, and for acting as representatives of exhibitors, the committee can recommend Messrs. Meyer H. Berliner, Günther, Behrend and Co., Wiesenhütter and Wandel, and D. Witte Nachfolger in Stettin. Every exhibitor is, however, at liberty to apply for this purpose, and for the protection of his interests, to any other firm in this city. 6. Exhibitors must be at the charge of insuring their own goods. The above-mentioned commissioned-agents are willing to undertake the insurance of exhibited articles. The committee cannot be held responsible for loss occasioned by fire, theft, &c., but will take the most ample measures for the security of the articles exhibited. 7. The name and residence of the exhibitors, and, if possible, also the price, must be affixed to each article exhibited. Articles which are not for sale must be marked as such. 8. Exhibitors are at liberty to charge either the committee or any firm of this city with the sale of exhibited articles. 9. Inflammable or easily exploding articles, such as spirits, oils, acids, corrosive salts, will only be admitted in strong and well secured glass bottles. 10. Articles for exhibition will be received by the committee in the Exhibition building from the 1st of April to the 1st of May, 1865. No article can be withdrawn or sent back before the close of the exhibition. 11. Articles of great size or weight, the placing of which will require considerable labour, must be sent before the 15th of April. Bulky articles, which will have to be sunk firmly in the ground, such as machines, must be specially mentioned in the notice sent in by the exhibitor. 12. Exhibitors, who may wish to have their machines worked by steam, must make the necessary arrangements with the committee beforehand. 13. Exhibitors, after obtaining permission from the committee, may appoint assistants to keep in order the articles they exhibit and explain them to visitors; but such assistants will not be allowed to offer such articles for sale. 14. At the close of the exhibition there will be a distribution of prizes, the manner of which will be subsequently fixed and made known. Application has already been made to Government for permission to dispose of the exhibited articles by way of a lottery.

Proceedings of the Society.

Fourth Ordinary Meeting.

Wednesday, December 7th, 1864; William P. Andrew, Esq., in the chair.

The following candidates were proposed for election as members of the Society:—

Abel, Charles Denton, 20, Southampton buildings, W.C.
Brinsmead, Henry, 12, Rathbone-place, W.
Sharp, Philip Henry, 18, East-parade, Leeds.
Simonds, Professor James B., Royal Veterinary College, Camden-town, N.W.
Simpson, J. Hawkins, 40, Bedford-place, Russell-square, W.C.
Smart, James Joseph, United Service Club, Pall-mall, S.W., and 3, Lambton-terrace, Westbourne-grove, W.
Sundius, Charles C., 54, Picadilly.
Thompson, Frederick, Urmstone Lodge, Wimbledon-park, S.W.
Varnell, Professor George, Royal Veterinary College, Camden-town, N.W.
Wetherfield, George Manley, 35, Moorgate-street, E.C.

The following candidates were balloted for and duly elected members of the Society:—

Barker, Charles Stuart, 12, Buckingham-street, Adelphi, W.C.
Durham, Makin, Thorne Hall, Thorne, Yorkshire.
Gale, William Joseph, 32, Torrington-square, W.C.
Hale, William, 6, John-street, Adelphi, W.C.
Kirchner, John, Peckham-common, S.
Partridge, William, 48, Newgate-street, E.C.
Pistrucci, Valerio, 28, Camden-street, N.W.
Pite, Frederick Robert, 38, Bloomsbury-square, W.C.
Pittar, Arthur, 4, Kensington Park-gardens, W.
Rowlands, Percy Jones, 24, Notting-hill-terrace, W.; and India Office, Westminster, S.W.
Slater, Robert, 104, Fore-street, E.C.
Smith, William Binns, 3, Upper Bedford-place, Russell-square, W.C.
Thompson, F., South Parade, Wakefield.
Tichborne, Sir Alfred, Bart., Tichborne-park, Hants, and 13, James's-street, Buckingham-gate, S.W.
Todd, William, 24, Wellington-road, St. John's-wood, N.W.
Tozer, Thomas, 55, Dean-street, Soho, W.
Van de Weyer, M. Sylvain (Belgian Minister), 3, Grosvenor-square, W.
Venning, Walter C., 9, Tokenhouse-yard, E.C.
Verschoyle, Colonel H., 23, Chapel-street, Belgrave-square, S.W.
Wilson, George, Cyclops Steel and Iron Works, Sheffield.
Wingate, James Forman, Club-chambers, 15, Regent-street, S.W.

The Paper read was—

THE CONSTRUCTION, TRACTION, RETARDATION, SAFETY, AND POLICE OF RAILWAY TRAINS.

By W. Bridges Adams.

Wagons and carriages are kept short on railways in order that they may roll round curves. Viewing a train of wagons from a bridge, every wagon will be seen to oscillate from side to side on the rails, following the course of curves and irregularities. Every wagon is drawn by a loose coupling chain, some eighteen inches in length, and the oscillation is so violent that, though goods and coals suffer it, and suffer from it, it would be unendurable by passengers, so the carriages of passenger trains are close coupled together to keep them steady. But in this process the wheels, as constructed, are debarred from following their own courses, and are compelled to slide. The result is a great wear of flanges and of axle-brasses, and a large consumption of coke. Were a train of goods wagons as close coupled as the passenger trains it would be simply impossible to move them. The first thing an engine-driver does, when about to start a goods train, is to back the whole of the wagons one on to another, and then start them one at a time in succession, by snatch after snatch at each chain, which is therefore required to be of enormous strength, in proportion to the resistance of the vehicle to traction by reason of bad structure.

The necessity for close coupling the passenger trains, arises solely from want of the efficient structure to induce free movement to make each carriage tractable instead of resisting—docile and not wilful. The first thing is to attain great length to prevent pitching movement, just as

is the case with vessels on water. But with long vehicles, radial movement of the axles must be attained, as described in a former paper. Radial movement may be obtained by radial axle-boxes to the end wheels very effectually with one pair or two pairs of central wheels to serve as fulcra on the rails, or with frames of iron fixed to the axle-boxes and guided by the traction rod and buffer. The traction rod in such cases will serve in the same mode as a carriage pole on the highway. And swivelling buffer springs will, by coupling chains attached to the iron frames, keep the wheels in the right position while backing the train on curves. Or, if two pairs of wheels, coupled together at each end of the frame, be arranged with a quadrant or a pivot over one axle and a radial curved bar over the other axle of each pair, they will be self guided on the rails, and a carriage thirty feet long may thus roll round a curve of fifty feet radius, and the steadier will it run, and the less will be the likelihood of getting off the rails, and moreover the less will be the proportionate dead weight of the vehicles to the available load it carries, if it be rightly constructed. The Americans and other people use long carriages with swivelling trucks supported on a centre pin, which also have eight wheels, and thus radiate the axles imperfectly, though, if the trucks have not length enough, say two feet more than the width of the gauge between each pair of axles, they will not run steady, but will drag their wheels. If the radial system be applied, it would be quite possible to make carriages forty feet long with eight wheels to roll round a curve of 60 to 80 feet radius. A rough model of a vehicle of this description is on the table, and the guiding apparatus of the wheels is not intended for a bogy carrying the load, as in the American carriages, but simply a radial guide, the load of the upper frames being borne by the springs on the axle-boxes, with facility for elastic sliding, or swinging on long vertical shackles.

Some time back a series of medical papers appeared in the *Lancet*, on the subject of the injury experienced by a certain class of patients from railway travelling. The fact was strongly denied by railway authorities, and by many persons in good health who were not authorities. Not long back a railway engineer who had been very doubtful of the injury, informed the writer that he had changed his opinion, for, being out of health, and desiring to travel backwards and forwards to Brighton, he found he could not do it on account of the injury caused by the vibration.

It may be remembered, that when the Brighton line was first opened, numbers of City stock-brokers and merchants took houses at Brighton, and yearly tickets to travel up and down daily, in short, to live at Brighton and transact their business daily in London. The writer has been informed that many ceased the daily practice at the end of the month, and at the end of six months it was found that hardly any could stand it and preserve their health.

Now, what is the reason of this? The carriages were as comfortable and easy, and as well ventilated as an ordinary sitting room when not in motion, and the only difference therefore could be, that the sitting room is stationary, and the carriage moves. But what is the kind of movement? There must be something peculiar in it for physicians to order their nervous patients to travel by road and not by rail. There are two mechanical differences. The road carriage has wheels proper, with independent movement and elastic wooden spokes, and elastic springs, and the wheels roll over a rough but not constantly hard surface. Riding in an omnibus along Cheapside, the rider finds the stone pavement hard and irregular, and the iron pavement much harder though regular, and the iron is the most unpleasant of the two. The rail carriage has a kind of iron garden rollers for wheels, and they run on a small but hard iron surface. If the carriage be travelling at a mile an hour, as when starting from a station, the movement is scarcely perceptible, but when at thirty to forty miles an hour, the vibration becomes unpleasant to most, painful to many. In slow movement the wheels can adjust themselves to the rails, and roll or slide easily. In rapid movement they have no time to adjust themselves, but slide as well as roll with incessant jerking. On very sharp curves the movement is sometimes all sliding.

It is this sliding which constitutes the difference. We may illustrate it as follows. Everybody knows that the sound of a violin is induced by rubbing the horse hair string of a bow over the strings of the violin, both being in tension. But the simple horse-hair will not produce the effect. To produce sound the player applies powdered resin to the horse-hair to induce friction, and it is the leaping of these particles over the strings that induces the vibration resulting in "sweet noise." Sometimes, they who love loud laughter better than sweet noise, will, as a practical joke, apply a tallow candle surreptitiously to the horse-hair bow instead of resin, and then the vibration causing the "sweet noise" is stilled. Now the wheels on a rail are a contact of practically rough surfaces, which vibrate and induce torsion of the axle, and thus vibrate and jump, and the result is, not "sweet noise," but very unpleasant noise and jarring, which, if long enough continued, makes a nervous passenger ill, and tends more or less to counteract the peristaltic motion of the intestinal canal. If the rails and tires were rubbed with the tallow candle before alluded to, the vibration would cease, at least till sand enough had accumulated to counteract the effect of the tallow. But the engine-driver would not approve of this plan, as it would lessen the power of haulage.

How, then, is this vibration to be lessened? Firstly, by lessening the hardness of the rail, and rendering it elastic. Secondly, by rendering the wheels elastic. Thirdly, by permitting wheels, or tires, or both, to revolve independently of each other. Fourthly, by radiating the axles so that neither on curves nor straight lines will the wheel flanges be ground against the rails. Fifthly, by efficiently springing the carriages, using a double series of springs, as well known in private carriages. Sixthly, interposing a non-vibrating material, such as india-rubber, between the carriage body and frame. Seventhly, by so constructing the bodies that passengers may stand or sit at pleasure. The blood cannot circulate freely when in a constant sitting position. Sedentary employment is a common source of paralysis.

The next question is that of brakes in absorbing momentum by friction.

When a large mass of material is put in motion it requires at first a much greater amount of power to start it into motion than it does to keep up that motion when speed is attained. The power required to get up the speed is called momentum, and if it be required to stop the momentum it must be absorbed by friction or gravity. If the stopping-places of railways were always on ascents there would be no need for brakes; gravity would supply the place of friction. And if the starting places were always on descents, little surplus power would be needed to produce momentum, as gravitation would furnish it. But momentum has to be absorbed under many varying circumstances,—sudden obstacles to be averted or stopped short of,—stoppage at stations,—and the descent of long inclines; also the ascent of long inclines, in case of couplings breaking or wheels slipping.

In the early times of tramways the Convoy (*convoi*) or brake carriage was used with the train. In the early times of railways brakes were applied to first-class carriages, each worked by a guard, because the first-class were the heaviest. But people who paid first-class fares demurred to this, and sliding brakes were adopted, working on the wheels and axles without attachment to the body, and thus jar was lessened but noise was increased, and so the brakes were transferred to second class, and then the old Convoy—the brake van—was revived, one at the head of the train next the tender, and the other at the tail, and when the train was heavy, one in the middle

But it was to a very small portion of the total weight of the train that the break power was applied, and the guards screwed down the blocks tight, and so skidded the wheels and ground flat places on the tires; and to apply brakes rightly every wheel in the train should have a brake block applied lightly to it, from the engine to the last carriage. The engine should have brakes pressing on both rails and wheels, applied by the driver, through the agency of steam friction, by simply turning a steam-cock, the pressure being divided between the rails and wheels in in any convenient proportion. Brakes on every vehicle in the train and on all the wheels would reduce the pressure required on each to a minimum. The system of "continuous brakes," as they are called, is applied to as many vehicles as the power used can reach. But the power used is commonly hand-power, and that is limited.

A new mode has lately been adopted on the North London line of making the momentum destroy itself. On this line of short mileage and many stations, with frequent trains, it would not be possible to work the traffic without the means of rapid stoppage, *i.e.*, the utmost rapidity short of concussion. For this purpose a chain of sufficient strength to draw the whole train is extended beneath and throughout the train. When this chain is drawn straight, the blocks are all on to every wheel, and when the chain sinks into a succession of curves, or bights, by a weight beneath each carriage, the brakes are all off. To draw the chain straight, a pair of heavy cast-iron disc wheels, with a barrel or drum on their axle, are then suspended in slings below the last carriage. The guard, by means of a screw, brings these suspended wheels into close contact with the running wheels of the carriage, and the friction causes the disc wheels to revolve by the momentum and to wind up the continuous chain on the barrel till it is drawn straight, and the brakes are all on, when the disc wheels begins to slip, and the momentum of the train is absorbed by the brakes. In this mode a train of fifty vehicles may be stopped in as short a space as a single vehicle, the right amount of friction being applied to each. This arrangement, however, requires either that the chain be carried through the whole train, and accurately connected with the proper lengths of chain to each carriage, the whole train being pulled close together, or that the break-van at one end and the engine at the other, serve as fixed points to lift the counterbalance weights and draw the chain to a straight line. There is no doubt of this acting well on trains fitted for the purpose, but the writer has not yet seen it applied to mixed and irregularly made up trains.

With regard to the application of brake blocks, there is an advantageous and a disadvantageous method. If applied to the fronts of the wheels, that is in the direction of the pulling engine, they do not chatter on the wheels, whether fast or loosely applied, but when brought into contact with the backs of the wheels they do chatter, till the pressure becomes very strong, so strong indeed as to skid the wheel. The longer the block, *i.e.*, the longer the surface of tire it embraces, the less is the chatter. But it would be far better to arrange the blocks between adjoining wheels, so as to press both rail and wheels, and in this mode there would be no chatter.

But though the continuous brakes before described act so well on continuous trains of vehicles, the action depends wholly on the continuity of the chain, as well as quick movement to apply them. If the chain separates, the brake action ceases at once, and this on a steep gradient might be disadvantageous. It is, therefore, desirable to have the brakes self-acting, if possible, without depending on the human hand, and operating on every vehicle independently of the others—operating also instantaneously when required. The writer was led to study this question, owing to the necessity of enabling the brakes to follow the wheels of radial carriages on curved courses.

To put this in practice brake blocks are suspended from cross shafts attached to frames resting on the axle-boxes of the wheels. To these blocks long weighted levers are fixed, which cause the blocks to press against the wheels with either a steel-yard action or, what is called, an elbow joint, four blocks being used, one to each wheel, with two levers or rods to cross bars. Thus the normal condition of the blocks is, to be pressing on the wheels with a power sufficient for the purpose. The lever ends are attached to the brakes rod by a chain passing between two pullies on the carriage frame, and as in the process of traction the rod moves lengthlong in the carriage to either end, the chain lifts the levers vertically, the traction force of each vehicle being sufficient for this purpose, and this process operates on every vehicle so fitted, even though ordinary vehicles be interspersed in the train; and in ascending an incline, if a traction coupling parts or breaks, these self-acting brakes will instantly press on the wheels before back movement of the wheels can commence; and in going down hill the brakes will be lifted while the engines is pulling, but will be in action directly the engine is slowed, and they may thus go on pressing and lifting, and so moderating the speed down an incline. It may be objected that the power of the brakes might thus be in excess, and so be a disadvantage, but to equalise this, every vehicle is to be provided with a hand lever, which will enable the driver to put temporarily out of action as many brakes as he may choose, leaving in action the number required for his purpose. The model of the carriage on the table is on a length of rail which may be placed on the level, or at angles of one in 1, in 20, 60, 50, 40, 30, 20, and 10. It will be found that brakes so applied, will retain the vehicle on an incline of one in fifteen, and by snatching the brakes rapidly off and on, starting and stopping may be rapidly performed. In practice the ends of the levers may have sliding balance weignts applied, so as to increase or diminish the pressure by the length of the leverage. It must be borne in mind, that the tractive force required to draw the wagon while running, must govern the weight required to be lifted at the brake levers, and in cases where much weight is needed, the mechanism for lifting must be arranged accordingly. When the whole of the wheels are provided with brake-blocks, a comparatively slight pressure on each tire will suffice.

The longer the vehicle the longer may the brake lever be, and the more effective will the vehicles be both for goods and passengers. Coal wagons are made short, for the convenience of getting close to the pit's mouth, but the model on the table, representing a wagon 30 feet in length, will roll round curves of 50 feet radius, and by its great steadiness will carry the coal—a very friable substance, with far less breakage. And a long wagon may be made considerably lighter in proportionate dead weight than two short ones, thus adding to the available load. In these days of competition in coal transit, this is a very important consideration. The self-adjusting brakes described will work equally well, whether the engines be on straight lines or sharp curves, as the levers are arranged to act equally well in either case. And as it is needful occasionally to back the train, for which purpose the brakes must be out of action, this may be accomplished by connecting the traction rod to the buffer rods or buffers by spring agency, so that the thrust of the engine may lift the chains and brake levers in succession, and put the whole out of action, or they may be lifted by hand levers as at present practiced. This class of brakes is especially adapted to steep gradients. There is nothing new in the principle now proposed. It is the safety principle in the cages of mining shafts and on some railways with rope traction.

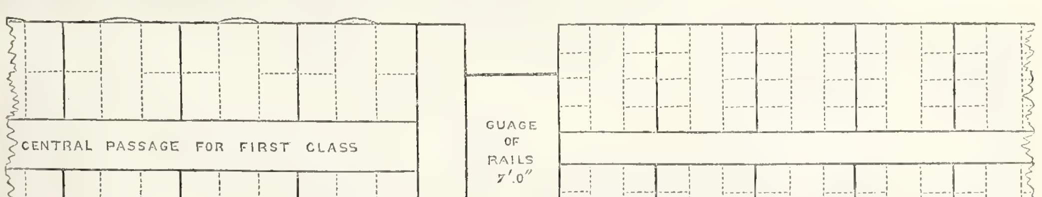
The last question we have to deal with is what we may call the police of railway trains. This is a question of structure. Trains are subject to catch fire on the roof; passengers may be taken suddenly ill; murders may be taking place, or other violence, but the sound of the train deadens all other sounds, and neither driver nor guard

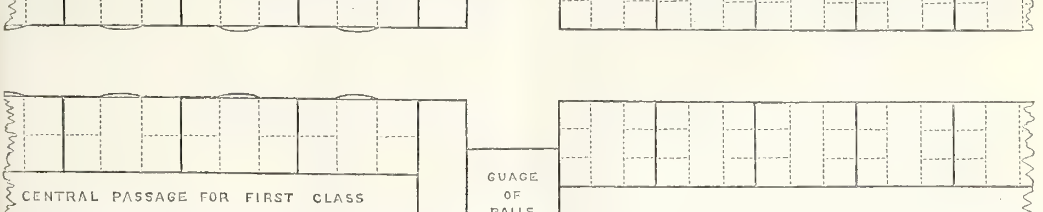
knows of it. And so there is an outcry for communication between passenger and guard, and guard and driver. And there are propositions for galleries outside the carriages for guards to walk along and catch murderers in the act. It seems to be forgotten that this facility for the guard would also be a facility for the thief or murderer. The practicability of these things is not considered. It is common to talk of the "six-foot" between the two lines of rails as giving ample space for the guard's gymnastics, forgetting that the "six-foot" is reduced to two feet by the overhanging carriages, and that two guards on opposite lines would thus come into collision, and, in American phrase, be "rubbed out."

If the guard is to patrol the train, there is but one way of doing it—through the inside—a passage way through the whole length of the train. Third class would probably not object to this, as they are disposed to be gregarious, and would not object to a guard or policeman additional, but second class might object, and first class assuredly would, on the score that they had paid their money for space and privacy. If it were put to the vote there is little doubt that the vote would be for privacy and a certain amount of risk, rather than gregariousness without risk. It must have been a matter of observation to those witnessing the starting of trains, how first class passengers walk along till they find an empty compartment, and, failing in this, make for one with the fewest occupants. And second class will do the same.

Were the lines single there would be no difficulty, as the carriages might be widened at least to the full extent of the tunnels, but with double lines the "six-foot" is the limit, and sometimes the "six-foot" is only five feet, and even less. With the six feet it would be practicable to have carriages two feet wider, provided only that the passengers would consent to have a wire guard to the windows limiting the protrusion of their hands, like the grating to the windows of a Spanish house. With a carriage ten feet wide, it would be quite practicable to have a closed passage in the centre, two feet wide, and compartments for four persons each, thus getting rid of the objectionable centre seats. The external doors would be retained, and there would be sliding doors inside opening into the central passage, communicating with end platforms. The second class and third would dispense with the closed passage. Sliding doors, glazed, would prevent the entrance of wind or rain through the central avenues. In this mode it would not be merely on the guard that the passengers would rely for protection, but also on the facility of intercommunication with each other in case of necessity. But if the brakes were all left to the driver, as they should be, the guard would have ample leisure to attend to the police of his train, instead of having his time taken up with the mechanism. Great Western carriages in the first class are divided length long by a partition, with the disadvantage that the compartment next the platform on the near side has to serve as an ante-room to the other. If the carriages were two feet wider this difficulty might be avoided by a central passage. No doubt this might be all very much simplified by making the whole train a series of open saloons, as in America, but public taste must decide this; and even in America they are now beginning the system of private compartments. With the exception of occasional alterations at platforms, it would be quite a practicable thing to widen the whole of the existing carriage bodies, by dividing them in the centre longitudinally and inserting the extra width as ships are occasionally dealt with to lengthen them. And there would be one considerable advantage, that by widening the train the length might be shortened, or a larger number might be carried. It may be objected that a small number—four persons—in one compartment might involve risk in plotted crime; but it would be quite practicable to make one side of the vehicle closed and the other open compartments.

Broad Gauge.





Narrow Gauge.

As a matter of safety in case of collision, the larger carriages are preferable, as they do not mount on each other's backs. As regards the expenditure of momentum by sudden stoppage, which throws passengers violently in each others faces, the safe remedy would be sitting sideways instead of fore and aft; they would be shoulder to shoulder, and in the safest position; but even in this case it is possible that they would prefer the ordinary position with risk, to side-sitting without risk, at least till they had a practical verification by frontal damage to their persons. The subject is so large that the writer has only dealt with it summarily, but a useful purpose will

have been answered should the paper have given new materials for thinking.

In conclusion, it will be well to help the memory of the reader by a summary of the various propositions contained in the two papers having reference to the amendment of corresponding defects:—

1. Spring tires, for the purpose of preventing blows and friction and lessening the chances of the wheels escaping from the rails, a system thoroughly verified in practice, as quadrupling the durability; illustrated by a woodcut.

2. Systems of elastic permanent railway, supporting the rails by continuous elastic bearing, preventing disintegration of the rails, as verified in practice; illustrated in timber and metal, by woodcuts.

3. Improved system of fish-joints, duplicating the strength, with elastic fit of ribs and bolts; illustrated by a woodcut.

4. Radial axle-boxes, to enable locomotives of great length to pass round any sharp curve without friction on their flanges—in practice; illustrated by a woodcut.

5. Eight-wheel tank engines for sharp curves of 99 feet radius, long verified in practice; elevation and plan illustrated by woodcut.

6. Eight-wheel tank engines, for curves of 99 feet radius, all eight wheels drivers, both on straight lines and curves, by means of super-improved friction-wheels, all capable of retardation by steam brakes, making the whole weight of the engine available for traction or retardation; illustrated by woodcut.

7. System of V flanges to spring-tires working into V grooves of rails, to obtain increased bite for ascending steep inclines, or when starting with heavy trains; illustrated by a woodcut.

8. System of long waggons and carriages on eight wheels, radial axles, and guided by quadrants, with sliding springs, or long swinging shackles, to roll truly round curves of from forty to eighty feet radius, and provided with self-acting brakes, to prevent accidents on steep inclines—economically and easily carrying large loads.

9. Mode of constructing passenger carriages to give free internal circulation to guard, engine-driver, and passengers without interfering with the privacy of first-class passengers; illustrated by woodcut in plan.

These principles and plans are applicable to all gauges, from 7ft. to 3ft. 6in. light lines.

DISCUSSION.

Mr. Dyer said they must all feel much indebted to Mr. Adams for his paper, which contained many valuable practical suggestions, but it did not embrace the popular view of the safety of railway trains by night and by day. The popular view was how the safety of passengers could best be secured, and how the casualties of railway travelling could be diminished. With this in view he would call attention to a few statistics taken from the annual reports of the Board of Trade, which showed that there was great loss of life annually throughout the kingdom from railway casualties. Those statistics had been tabulated only since the year 1861, in which year he found that there were 284 persons killed and 883 injured; in 1862 there were 216 killed and 600 injured; and in 1863 there were 184 killed and 470 injured. These figures showed a large amount of loss of life and injury to persons by railway travelling, making a total for the three years of no less than 2,637. The question in which the public were interested was, could this loss of life and injury to person be reduced? and in this they were more interested than in the mechanical management or construction of a railway. A great number of lives, he believed, might be saved, in cases of collision, by a contrivance (a model of which he had placed on the table), and which, he said, would prevent the upsetting of carriages in case of collision. The loss of life occurred, in a great measure, from the upsetting of carriages on the road. If the carriages could be maintained in their proper position, the passengers would seldom suffer more than a violent shaking, but immediately a collision occurred the upsetting of the carriages ensued, and loss of life and injury to person, to a great extent, was the result. He considered the present buffer arrangements of trains extremely faulty, inasmuch as their line of action was too low, and gave a leverage, or pressure, which in case of collision lifted the carriage over. He held that there ought to be what he termed a square pressure from end to end of the train, which would enable the carriages to sustain the pressure without being upset; in other words, the carriage could be pressed to the extent of the crushing power before it gave way. The arrangement he suggested consisted of a top and bottom line of buffers, which rendered a train like a continuous carriage in point of resistance to pressure from end to end. If the train could be formed of one continuous carriage, upsetting would be impossible, for, however violent the concussion might be, it would be impossible to upset the carriage. The arrangement of buffers he had suggested would practically make the train into a single carriage. Another question was the frequent loss of life that occurred at station platforms, from persons getting in or out of carriages while in motion. He submitted that all the platforms should be built up to the level of the flooring of the carriages, and that a dangerous space between the platform and the carriages ought not to exist. There was great want of uniformity in the height of railway platforms. He found at Charing-cross station the height of the platform was three feet, while the average height of the flooring of the carriages was about four feet from the rails; consequently, there was an ascent of twelve inches to the carriage. At London-bridge station it was about the same. On the Brighton line, at London-bridge, the platform was only twenty-four inches in height, which gave an ascent of two feet to the carriages, with a space of eighteen inches between the edge of the platform and the carriages, and this he held was dangerous in the extreme. However thoughtless or stupid the public might be, they found that casualties from falling between the edge of the platform and the carriages frequently occurred to the servants of the companies, who might be supposed to know the danger that existed. Mr. Dyer instanced the casualties that had lately occurred from this cause at the Erith Station, when the platforms were crowded with persons returning from the scene of the recent explosion there. He also quoted from the Board of Trade returns other accidents which he said were merely recorded as "passenger killed from own want of caution," &c. He thought the Government ought to instruct the inspectors to inquire into and report the conditions and particulars under which the occurrence took place, but this was not done, except in the more serious cases of accidents. He thought many of the present dangerous arrangements on railways ought not to be allowed to exist, and that it was the duty of the Government, upon the neglect of the companies themselves to do so, to enforce the necessary precautions to ensure the public safety.

Captain Humby could not see the practicability of the arrangement of buffers that had been just suggested, to carry out which would involve the necessity of building excessively heavy carriages, whereas it was considered essential, both in regard to speed and comfort in travelling, to build them as light as possible. He thought if such a system had come under the notice of Mr. Adams in a way that he could entertain, he would have noticed it in his paper, and given his opinion upon it.

Mr. S. Teulon said the last speaker but one had suggested that railway carriages should be provided with two sets of buffers. He would appeal to gentlemen who had any knowledge of mechanics and of the laws of bodies in motion, whether it was not undisputed that the best point at which to stop a body in motion was not as near as possible to its centre of gravity. In the case of an engine

with the boiler filled with water, and perhaps carrying a tank on the same frame, he submitted that the line of the centre of gravity was not very far from where the buffers were ordinarily placed. At one time the practice obtained of stopping trains on sidings by the very ready but, as it had proved to be, very dangerous method of turning up the ends of the rails. The consequence of this arrangement was, that as the centre of gravity was above the wheels, they, coming in contact with the bent-up iron, had a tendency to be thrown out of their places. The remedy for this was found in putting up an earth bank, against which the buffers impinged, and he could state, from his experience on a very large railway, that since that plan had been adopted the injury to the wheels and axles had been largely diminished. In the plan now suggested what would be the consequence of anything happening to the lower buffers? If the top buffers took the strain, it would push the roof off the carriage, which, he apprehended, would be very inconvenient to the passengers inside it. With regard to the complaint that the platforms were not placed at a uniform convenient height, it must be remembered that railways were not the system of a day. They had gradually grown up, and improvements had succeeded from time to time. In making a new station, such as the Charing Cross, the directors had adopted a higher platform. The Brighton station was built many years ago, but he had no doubt, when it became necessary to make new stations, the directors of that company would follow the example of their neighbours, the South-Eastern. While speaking of the Brighton Railway, he would notice a passage in Mr. Adams's paper, in which he referred to a subject which had excited a great deal of public discussion, viz., the alleged injury to the health of persons constantly travelling by railway. The best answer to that allegation was the fact that, taking the statistics of the Brighton Railway, he found a very large increase from year to year of the class of passengers daily travelling to and from Brighton and intermediate stations as season-ticket holders. The report which was distributed among the shareholders of the South Eastern Railway Company in the early part of this year contained a table, which showed that while in 1855 the season tickets brought in near £21,000, the amount had gone on increasing year by year, with but one exception, until up to the present year it reached the sum of £34,693. He at one time, as a traveller by railway and road 72 miles, four or five days in a week, fell into the notion that he was being seriously injured by his railway travelling; but he must own now, having continued that injurious practice for upwards of ten years, he had the satisfaction of enjoying much better health than ten years ago. It was fair he should state the result of his own experience. He attributed much of the injury which some passengers suffered to this cause, viz., the short time that persons gave themselves to reach the station, which led to their arriving and entering the carriages in a flurried and heated state, unfit for travelling, especially in cold weather. They sat in drafts caused by the carriage moving rapidly through the air, and the caloric of the body was rapidly drawn from the feet, and the proper circulation of the blood interrupted. He turned from this question to the practical matters treated of in the paper. With many of the points advocated by Mr. Adams he entirely agreed. He agreed that a great deal of the mitigated wear and tear of railways and rolling stock was to be attributed to the better form of construction both of the line and the working plant. He had taken a little trouble in this matter since the last meeting, because he held it was of great advantage to discuss these subjects with a number of gentlemen more or less conversant with it, and although they might not agree on all the opinions expressed, they were in all cases the better for exchanging ideas with each other. In the year ending 1855, on a railway on which 2,272 carriages were employed, it was necessary to "turn up" from wear 1,884 pairs of wheels. The actual result was ·6726 as the proportion of wheels turned up in 1855, whereas for the year ending July last, the number of vehicles having been materially increased, and increased in size as well, the capacity of the waggons being increased from four and five tons to eight tons, they still found this gratifying fact, that the ·6796 in 1855 was reduced in 1864 to ·6533; and it was an equally gratifying fact that the quality of the tires—a matter on which Mr. Adams properly laid great stress—had very much improved, especially the Staffordshire tires. He found, on a comparison between the wheels used on two of the large metropolitan lines, that while, in the four years ending 1863, when a great many Low Moor tires were used on the one line, the result was a loss of ·60945, on a neighbouring line with Staffordshire tires it was ·60990, being a mere difference of $\frac{4}{10,000}$, and showed very favourably for the Staffordshire iron, which, ten years ago, they hardly dare use, as the quality did not near come up to that of Low Moor. With regard to wheels, the railway he was connected with (South-Eastern), gradually, during the last fourteen years, ceased to have perfectly solid iron wheels; they employed wood placed endways above a plate inserted for the centre of the wheel, and built up to form a wooden disc on which the tire was put by hydraulic pressure; they had also done this, and done it very successfully, viz., placed a rim of wood between the iron wheel and the tire. He should state that the former plan was patented by Mr. Mansell, the carriage superintendent of the South-Eastern. As the tires had become worn, they had cut out of hard wood a segment of an inch or inch and a half, and placed them between the inside of the tire and the iron forming the old wheel. These plans had answered so well, that whilst during the last severe winter, the tires of 150 pairs of wheels, some on iron, had elongated, where this hard wood had been placed between the tire and the wood of the disc, there was no wheel amiss, a very important matter in times of severe weather. The elongation of tires in winter time had been a very vexed question, but he thought a little consideration would bring them to this conclusion. The road in severe weather, especially if the frost had been preceded by wet, was in its most rigid state, Then the inner portion of the wheel, when of iron, was in effect the same as if the tire was placed between rollers, and consequently it elongated the tire. With reference to the model of an elastic road shown by Mr. Adams, he imagined that was another move in the right direction, and that plan had been adopted on one of the lines running from Manchester. The chairs were placed between the wheels, as in that model, and he stated this on the authority of Mr. Ashcroft.

Mr. Adams—If the plan was good why did not Mr. Ashcroft employ it on his own lines?

Mr. Teulon said it must be well known to Mr. Adams that a framed longitudinal road was formerly employed on the viaduct portion of the Brighton line, and was one of the best parts of the line; but owing to the great number of trains, when it was taken up it was impossible to put down another road like it. It was, however, in use some ten or twelve years with success. With regard to the spring tire wheels which Mr. Adams had shown, he (Mr. Teulon) thought that in ascending inclines difficulty would be found, inasmuch as the wheels would slip in the tire for want of sufficient friction.

Mr. Adams—The objection could only apply to the driving wheels of engines; as regarded other wheels facility of slip was a positive advantage. As regarded driving wheels positive experiment, which was worth more than any theory, had demonstrated that even when the tires, as stated in the paper, were so loose that they could be moved round by hand (with the weight lifted), they drew their load perfectly well. Mr. Adams would go further, and say that loose tires, even without springs, would act in the same way, although of course disadvant-

ageously for want of the elastic interception of blows, and the equalising movement of the tire on its basis of contact with the rail.

Mr. Teulon added that Mr. Adams had stated very correctly that all changes with regard to railway plant, especially with heavy and powerful bodies like engines, must be made with great caution, and therefore he was content to wait on this point till he saw more of the results. In conclusion he would say a word on the subject of the fish-joint. He saw by Mr. Adams's previous paper that he did not call in question the fish-joint at present in use, but he said he had got something better. He (Mr. Teulon) thought the public was very much indebted to Mr. Adams for his original fish-joint, and he hoped that gentleman had reaped some of the benefits of that invention. [Mr. Adams—Not a sixpence.] It was a good joint if the fish were properly made, and was one of the best things that had been introduced on railways for a long time. He would not say Mr. Adams might not have improved upon it, but the original joint had been a great advantage to all railways that used it.

Mr. Adams, in reply to the observations that had been made, said the model of the suggested application of double sets of buffers was simply a supplementary mode of attaining what he himself had advocated in the paper, viz., the long carriage. In the early days of railways a single buffer was used in the centre, but it was abandoned for the two side buffers. He did not agree with Mr. Teulon that it was a bad plan to put buffers in the position in which they were shown in the model, because it was notorious that short carriages would ride upon one another's backs. No sooner did they come into collision than, with four tons of buffer springs pressing, the first thing they did was to mount upwards on each other's backs, as they could not move downwards or sideways. That was well known from experience. He did not think that two sets of buffer springs, one above and one below, were desirable, but he thought it would be an advantage to apply cushioned blocks to the upper corners of the body, flush with the buffer heads when drawn home, to lessen the risk of the tilting upwards. With regard to the question of health, he could not fight against statistics; but in his paper he had alluded to what he understood was the fact, not that season tickets originally taken by gentlemen wishing to travel morning and evening to and from Brighton had been discontinued, but that very few persons could keep up the daily practice; and though the season tickets might have increased in amount *non constat* that all their owners travelled with them morning and night.

Mr. Teulon said his inquiry had been especially directed to that point, and there were persons travelling backwards and forwards continuously.

Mr. Adams was glad to find they had such quality of muscle in England, but one engineer had told him the practice did not suit him. And it was notorious that the faculty discouraged their delicate patients from the use of the railway. With regard to the wheels which Mr. Teulon had alluded to, before that gentleman had gone far in his remarks on that subject, he (Mr. Adams) was prepared with a reason why the wheels on the South Eastern Railways had lasted longer. It was solely due to the fact that they were wheels with solid wooden discs, which to a certain extent rendered the wheels true circles, and also removed the inner anvil from the tires. They could not hammer the tire on the surface of the wood as they could on an iron surface, just as the shoemaker in hammering his sole leather could not do it on his thigh as he could on a solid lapstone. As to wooden wheels, nobody knew more about them than he did. He was at one time a manufacturer of carriages and engines, and had turned out a great many of them. There came to him an order from the South Eastern Company for a number of very long carriages. Those carriages were notoriously the steadiest carriages that ever ran, but they did not answer in one respect, as he had not in them a radial movement of the axles, and the flanges cut against the rails. When the order for them was given, it was specified that the wheels were to be constructed on Mr. Mansell's patent. That patent was not for wood wheels, but consisted in applying, in an ingenious manner, a pair of angle-iron rings which keyed laterally into the grooves of the tire, and held to the wheel by cross-bolts through the wood, piercing through the head of the tire. In making a wheel the worst thing they could do was to make a hole through the tire, because it deprived it of a portion of its strength—probably one third. Another thing was, when the tire got loose on the wheel it indicated danger, which arose in this way—Where the tire was stretched by the process of rolling over the rails, the wheel being held down in eight points, it could not stretch where it was held, but became polygonal in stretching out between them, and the wheel in other parts became a sledge hammer, and in frosty weather the rivets got broken out. The original wheels of Mr. Mansell were composed not of a disc of wood, but of a series of screw spokes, the outside secured in the felly, and the inside in the nave of the wheel. On looking at that plan, he declined to make such wheels. He was asked how he would do it. He replied, make them solid discs with a series of radial timbers. He was told that was the patent of another superintendent, but he doubted the fact, as it had been done by Mr. Dircks many years before. He (Mr. Adams) had machinery made to cut the timber for those wheels, and they were the first that were thus made for the South Eastern line. He was then putting on Park-gate tires, said to be a brittle iron, but he found it perfectly hard, and of good quality. While these wheels were in course of manufacture, an accident occurred on the Midland Railway by the breaking of a tire, which cut through the bottom of the carriage, and nearly killed the railway king, Mr. Hudson. Inquiry was immediately made of the officials whose tire it was that had broken? and on being informed it was Park-gate, he issued orders that no more of those tires should be used on any railway of which he had the command. Upon this he (Mr. Adams) was asked if he intended continuing to use the Park-gate tires? He replied, he did. He was told they would break, to which he replied he was putting them on the wooden discs by pressure, and by no subsequent pressure could there be sufficient tension put upon them to break them. He believed these wheels had never broken a tire. The greater duration of the South-Eastern wheels was, therefore, due to the action of the wood, which prevented the rails and chairs becoming anvils for the tires to act upon. In America Mr. Griggs had put his engine-tires on with wood between the tire and the wheel, and by that means, no doubt, had increased the duration of the tire very considerably; but in the case of a wooden wheel, if the tire got loose by any chance, and began to move round, it would soon grind the wood wheel away. With regard to his plan of laying the rails elastically, a few years ago, Mr. Chubb, a director of the North London Railway, complained to him of the destruction of the rails on that line. His reply to that gentleman was, that they did not lay them right, and he offered to give him a plan if he liked to use it. He gave him this plan and it was determined to use it. A few lengths were laid down on the North London line with the ordinary rails and in other places. The rails did not touch the longitudinal timbers, and were supported, not by chairs, but by brackets. They had been down three years, but they exhibited no signs of destruction on the top, as was the ordinary result of the anvil action of the chairs and hard ballast. At the time he read a paper on this subject before the Institution of Civil Engineers, it was stated that that kind of road had been adopted before, but he was unable to find any trace of it, in any book or publication, or transactions. It was asserted that it had been done by Mr. Buck, who he admitted was a perfect judge of a good line. He inquired where it had been laid, and

was informed on a viaduct; but it had not been renewed on the same plan, and no one knew anything about it except those who laid it down. Mr. Teulon said he got his information from Mr. Ashcroft. Now the latter gentleman was a member of the Permanent Way Company, which had become possessed of his (Mr. Adams's) fish-joint. It was a company got together to secure all that was good in patents of every kind appertaining to the permanent way of railways. Mr. Ashcroft was, he believed, still a member of that company, and had a patent for a permanent way of his own, on which many heavy chairs were used, and it was only natural he should give the preference to his own plan. But that fact precluded either him or Mr. Teulon, who acted under his advice, from being unprejudiced judges of any clashing plan. He gathered from Mr. Teulon's remarks, that he wished, under his information from Mr. Ashcroft, to make it appear that he (Mr. Adams) was not original in his elastic system. But the truth he believed was, that Mr. Buck, a man in his own right, and not a copier, did use on a viaduct a system of interspacing his chairs between the rigid supports of the frames, to save the viaduct from damage. But in what was called the permanent way of railways, no such system was ever used. He (Mr. Adams) had embodied a known principle of nature to counteract the evil of hard ballast, more than once alluded to by the late Robert Stephenson, in discourses at the Institution of Civil Engineers. Mr. Buck was a man of clear perception, and he also took patents, but never took a patent for this elastic system, or ever mentioned it before scientific bodies. With regard to the framed longitudinal road on the Brighton line, alluded to by Mr. Teulon, it was laid with continuous bearing bridge rails on longitudinal timbers. The bridge rails deflected under the wheels and sunk into the timber to an inch or more in depth. An engineer of the S. Eastern line, when he first saw a rail removed asked, very innocently, "Why do you groove your rails into the sleepers?" thinking it had been done from the outset. This line was always harsh and rigid, and not one to be recommended. He (Mr. Adams) had devised a general system, and applied it equally to timber and metal sleepers, to prevent blows and breakage. With regard to the fish-joint, when the original joint was first produced, he (Mr. Adams) had not intended it to be used in the way it was now used. It was produced as a parallel support to the rail ends between two chairs, six inches apart; afterwards, for the sake of cheapness, it was proposed to bolt it. The form which was good in the chairs as a parallel fish was not proper as now used. It was notorious that the fishes bent at the joint, and as they had only three inches depth between the two upper tables of the rails, they were not deep enough to supply an equivalent in strength to the depth of the rails. Another thing was, they were parallel, and, being parallel, they added more strength than was wanted at the end of the fish to the rail, and that caused a blow, and less strength than was wanted at the joint of the rail, and that caused another blow. He (Mr. Adams) had now devised another form of fish. It so happened that the Permanent Way Company had made what they called, an improvement in fishes, and probably a dozen patents for improved fishes had since been obtained, and it was certainly competent for him, who originated the fish, to make improvements upon it. He did not think the public were thereby endamaged, nor did he think either the public or Mr. Teulon would desire to dispute his right to make a profit of his further improvements, even though the first fish had yielded a miraculous draught of coin to its possessors. He had seen few fishes of a worse form than the last pattern on the South Eastern line.

Mr. Davis wished to state that he had had some experience of the engine alluded to in the paper, as having been constructed for the St. Helen's railway, and was present, in company with the most eminent engineers and locomotive manufacturers, at the trials made with it on the North London line. When running on a straight line, at a speed of 68 or 70 miles an hour, he was very much struck with the beautiful motion of the axle-boxes. Running at that high speed, an inequality of the rails would sometimes cause the engine to give a jump on one side, but it immediately righted itself in the most beautiful manner. After the experiments he examined the wheels, and he noticed that the flanges were not abraded, but the tire had formed a groove corresponding with the surface of the rail. Although the papers of Mr. Adams were very comprehensive, there was one subject which had not been touched on. It had been stated in the discussion that where one carriage ran off the line, if the couplings did not break, the other part of the train would be dragged to destruction. He had had brought under his notice a very clever invention, by which the couplings of the carriages were so arranged that, taking into account the sharpest curves, the couplings, by a clever mechanical arrangement, immediately disconnected the carriage from the other part of the train, and saved it from destruction. He thought this contrivance should be more prominently brought before the notice of railway managers than it had yet been.

Mr. Adams said that on the St. Helen's engine they were all spring tires.

Mr. Davis replied in the affirmative, and added that he was much delighted with the sensible improvement in the non-vibration of the engine.

The Chairman had great pleasure in proposing a vote of thanks to Mr. Adams for his excellent paper. It was only to be expected that, looking at the scope of subjects embraced in this and the previous paper, difference of opinion on some points would arise. An objection had been taken this evening that Mr. Adams had not cared sufficiently for the public safety in railway travelling. Now if he understood aright the suggestions of Mr. Adams, they went very much in that direction, not only by diminishing the wear and tear of railways, but they had much to do with regard to the safety of the trains. He would not detain the meeting by entering into the fish controversy, but it illustrated the old adage that "there are as good fish in the sea as had come out of it." The first fish, and a good one, had been produced by Mr. Adams, and he was now ready to produce a better. Mention had been made of the safety of railway carriages, arising from their length and breadth, but no mention had been made of carriages having upper stories. For several years past that description of carriage had been worked on the Bombay and Baroda line, with much success and much safety, and so agreeable had it been found by the passengers, particularly the natives of India, that the company with which he was connected (Scinde, Punjaub, and Delhi) had adopted the plan, and used it for a considerable period. He would state as a question of railway management, that they could convey in one of those carriages very nearly as many passengers as they could in three ordinary carriages. Hitherto no accident had occurred, and the natives infinitely preferred the upper story. As one for many years connected with railways, he would express how gratifying it had been to him to have been present on this occasion, for he felt he had received a great deal of instruction, and it was very agreeable to him to hear that as they gained experience in railway construction the dangers of that mode of travelling were materially diminished.

The vote of thanks having been passed,

Mr. Adams acknowledged the compliment paid to him, and remarked that one element of safety in reference to those carriages on the Indian lines consisted in the gauge of 5 ft. 6 in., which allowed a wider base for the wheels of the carriages. With that gauge they could do a great deal more than with the national gauge of this country.

OPERATIVE COACHMAKERS' INDUSTRIAL EXHIBITION.

The following circular has just been issued by the committee:—

"The committee of the above have the pleasure to in-

form you that the proposed exhibition has met with more sympathy, support, and encouragement than they could have reasonably anticipated for so novel a venture in the coachmaking trade: not only has the Society for the Encouragement of Arts, Manufactures, and Commerce, consented to bestow its patronage on the undertaking, but the committee have secured the support and assistance of the Worshipful Company of Coach and Coach Harness Makers of the City of London. In reply to the memorial so numerously signed by all the principal London Coachmakers, and many of the most intelligent and enterprising of the operatives, the company have in the most handsome manner placed their Corporate Hall at the disposal of the committee for the purposes of the exhibition.

"The committee consider themselves most fortunate in having thus obtained the support and co-operation of two corporate bodies that have existed for so many years, and they anticipate the most favourable results from this connection of the City company, and trust that the advantages may be many and mutual.

"Messrs. Boulnois have kindly granted to the Committee the use of a most eligible committee-room at the Carriage Bazaar, King-street, comfortably warmed and lighted; this has been another great advantage, besides curtailing the expenses in a material manner.

"Although the sums receivable for admission will doubtless cover much of the expense, yet in so new and technical an Exhibition the Committee cannot look forward to any large sum from the general public.

"It is anticipated that by bringing together many objects of skill, ingenuity, industry, and curiosity, many and various advantages will be offered to the operatives, the coachmakers, and the general public, besides stimulating invention and skill. If the London coachmakers and friends and patrons of coachmaking will support the undertaking with subscriptions, the success will be rendered almost certain, and such success would tend to raise the trade of coachmaking to that position which it ought to occupy amongst the trades of the country, on account of the ingenuity and large capital, and very varied skill necessary to carry it on with success.

"A duly authorised person will, in a few days, call upon you, in the hope that the subject will receive your favourable consideration.

"Several sums have been already offered as Special Prizes:—

"Mr. G. N. Hooper offers three guineas for the best drawing of a town barouche on under and C springs—scale 1-inch to the foot. Open to foremen, carriage operatives, and apprentices.

"Also two guineas for the best drawing or model of a light hospital carriage to convey the sick poor. Open to all comers.

"Mr. G. A. Thrupp offers two guineas for the best stuffed and quilted carriage cushion in morocco leather. Open to coach trimmers only.

"Also two guineas for the best drawing in pencil upon paper (half the full size), of an under fore-carriage for elliptic springs, of usual or original design. Open to apprentices and improvers.

"It is suggested that such a special prize list offers an excellent opportunity to any individual or firm to stimulate skill, ingenuity, or invention in some particular channel that they may consider most useful; and directing the attention of the operatives to objects that would repay the time and thought bestowed on a subject, and which frequently unless guided has a tendency to be bestowed on matters that have no practical utility, though ingenious and clever.

"If you are the possessor of any curious models or carriage drawings, &c., that would be of interest in this Exhibition, the committee solicit your kind loan of the same during the period from January 21st to February 15th, 1865. The utmost care would be taken of them."

ADULT EDUCATION.

A conference took place on Nov. 22 at the rooms of the Society of Arts, John-street, Adelphi, in connexion with the Metropolitan Association for Promoting the Education of Ad lts, on the subject of the organization and management of night schools; Sir Thomas Phillips presided, and briefly explained the object of the meeting.

The Rev. Henry White, M.A., chaplain of the Savoy, delivered an address, prefacing it by stating that he had been largely mixed up in the conduct of night schools for several years, and that he had seen reason to change some of the opinions he had advanced four or five years ago. He proposed to confine his paper to the following subjects:—"The need for night schools specially suited to boys of an age stretching from 13 to 18. The desirableness of changing the name of night schools to the more attractive name of youths' club or institute. The best method of raising or adapting buildings for the use of evening schools. The advantage of reading and recreation rooms in connexion with the evening schools. The classes most needed to be formed for a boys' evening school. Are paid or voluntary teachers most to be desired and encouraged? How can night schools be maintained on self-supporting principles?" He then dilated at some length on providing night schools suited to boys between the ages stated, quoting a paper of Mr. Hollingshead, published last year in the *Daily News*, pointing out the difficulties under which "hobbledehoys" labour for want of congenial and profitable occupation in their leisure hours, and deducing from these premises the value of providing night schools, but under some other name, in which not only should educational facilities, but opportunities for amusement and social enjoyment be provided. He suggested that youths' club or institutes would be the more appropriate name for the institutions he contemplated, as expressing more accurately and attractively their proposed objects. The class he proposed to benefit was the sons of working men after they left school. He recommended that the National School-rooms should be used for these clubs or institutes, urging that it would be difficult to obtain the means of providing other buildings for the purpose, and that were it otherwise, the money spent in building or in rent might be much better employed. Besides, he believed that in the National Schools they would better secure the class of boys they desired to influence, and that this use of these schools would be advantageous in the education given in day schools. Again, there clustered round the National School a variety of institutes, savings bank, &c., of which the youths would avail themselves. He pointed out the various other advantages he anticipated from the adoption of this suggestion, as the obtaining of the government grant, the assistance of the National schoolmaster, and the sympathy of the parishioners. He considered paid teachers would be necessary for these night schools in addition to the voluntary educational and other help which would doubtless be afforded. He attached great importance to the assistance of ladies as a means of refining the habits, thoughts, and manners of the boys. He recommended compulsory attendance to at least three classes weekly, and that there should be a discretionary power of discipline. There should be a reading-room, a place for draughts, chess, and similar games, and opportunities, within certain limits, for education and social intercourse. This requirement might perhaps be met by devoting one hour previous to and one hour after study for amusement. And in the summer months there should be provision for cricket, boating, and gymnastics. He held it to be a vital point that those institutes should be self-supporting, and in this respect he admitted that he had committed an error in the institution he founded some years ago at the Lowther Arcade. The rate of payment must vary according to circumstances. 4d. to 6d. weekly had been found to meet the needs of London boys, but perhaps in the country 3d. or 4d. would be more suitable. He considered that there should be an

entrance fee of double the weekly payment, as an inducement to continue attendance, but there should be no extra payments for lectures, classes, or entertainments. He recommended that there should be periodical examinations aud distributions of prizes. All would, he thought, admit that some religious guidance was requisite for the members of these institutes. He would not exclude dissenters, but it was in vain to expect that a youths' institute could succeed upon the principle of embracing all denominations. He had seen many promising institutions come to grief from the impossibility of getting managers of different religious views to act together. If the dissenters desired such institutes they should provide them for themselves, but their starting point must be the church of England.

Mr. Harry Chester followed, explaining the advantages of Examinations as carried on by the Metropolitan Association, and showing the necessity of affording to the sons of the working classes the means of pursuing their education after the period at which they usually left the elementary schools. He described the nature and form of the Examinations of the Association, adding that none were examined under 16 years of age, and that the Examination papers were sent round to the localities where the pupils resided. He altogether dissented from the opinions of the last speaker as to the religious question, considering it of the greatest importance that members of the different religious bodies should be brought to act together in the work of education, and he was happy to say that he knew of several Institutions in which members of the different religious bodies laboured harmoniously together, and with the best results. He could state that the working classes were by no means indifferent to the value of continuing their education after leaving the elementary schools—on the contrary, there was a strong and even an enthusiastic desire for it. The Metropolitan Association did not confine itself to youths of between 13 and 18, to which Mr. White's paper was limited, but extended its facilities and its system of Examination to adults generally; and they actually found people coming up of the age of 45 or 50, although the majority were between 16 and 22 or 23. As to using the national schools for the purposes of these Institutes, he thought much was to be said on both sides, and pointed out numerous objections to the proposal.

Mr. Tabrum, hon. secretary of the Islington Youths' Institution, which had been alluded to by Mr. White in the way of illustration, offered some remarks explanatory of the system there pursued and the beneficial results.

A discussion followed in which the Rev. B. F. Smith, diocesan inspector of schools for the archdiocese of Canterbury; the Rev. Mr. Whittington, principal of the City of London College; Mr. Pearsall, secretary of the London Mechanics' Institution; Mr. Ford; the Rev. W. Baird, of Clare-market; Mr. Baker, of the Bayswater Institute; the Rev. A. B. Suter, Mr. Whittingham, Mr. Solly, Mr. Stock, and Mr. Currie took part.

The Rev. Mr. White replied briefly, and a vote of thanks was accorded to him and the Chairman.

Fine Arts.

Public Works of Art in Paris.—Architects, sculptors, and painters, have not for a long time enjoyed so much patronage as at the present moment in Paris. In all quarters of the city new buildings are rising; here a church, there an opera house, or a barrack, presently an hospital or a post office, and old edifices are being renovated and beautified. An important work has just been entrusted to a well-known painter, M. Robert Fleury, namely, the execution of four large works for the decoration of the great hall of the new Tribunal of Commerce, which has been recently erected, facing the Palais de Justice, and between it and Notre-Dame. The subjects selected are:—The Installation in 1563 of the *Juges Consuls*, or commercial arbitrators; the presentation, in 1673, to Louis XIV., of the Ordonnance of Commerce; the promulgation of the Code of Commerce in 1807, by Napoleon I.; and the inauguration of the present tribunal. The work will occupy the artist about three years. The river façade has recently been completed; it is ornamented with four colossal figures representing Law, Firmness, Justice, and Prudence, executed in Caen stone, by the sculptors Elias Robert, Endes, Hippolyte Chevalier, and Jules Salinson, and with cariatides by A. Carrier. In niches on the grand staircase are to be placed four grand allegorical groups, representing Maritime and Land Commerce, and Industrial and Mechanical Art, by Cabet, Michel Pascal, Maindron, and Chapu. A copy of the portrait of the Emperor, by the late painter, Flandrin, and which was exhibited in London in 1862, has been ordered of M. Ronjat for the great hall or audience chamber. The works connected with the courts of law and the prefecture of police have been pursued with great activity. One wing of the latter is completed as far as regards the outer walls; the new Court of Cassation is roofed in, and the ornamentation of the new façade of the Palais de Justice itself will be completed very shortly. The doors of the front, three in number, lead into the great vestibule, or, as it is called in Paris, the *Salle des Pas-Perdus*, a noble vaulted apartment. Within the latter is a very bold double staircase leading to the Courts of Assize. Another building, just commenced, will unite the old and new portions of the palace. The whole promises to be the most important work of the kind, after the Louvre and the Tuileries, executed in Paris for many years. Painters and sculptors are beginning to think of the annual exhibition, and are pushing on the works they have in hand rapidly; the decoration of four chapels in the church of Clignancourt, commanded by the authorities of the city of Messieurs Barrias, Emile Lafon, Michel Dumas, and Romain-Cazes, are approaching completion. The pavilion and wing of the Tuileries, which have been rebuilt, are now being crowned wth elaborate ornaments in hammered lead, and the ornamental work of that part which abuts on the quay is being commenced. On the other hand, the whole of that portion of the great gallery which was built in the reign of Louis XIV. is demolished, and its reconstruction, in harmony with the work of Henry IV., will be commenced forthwith.

Public Statues in France.—A grand monument is about to be erected to the Chevalier Bayard, the knight who gave François VI. his spurs on the battle-field, on the ruins of what was once his castle.—A monument to the memory of the painter, Hippolyte Flandrin, is to be raised in the old church of Saint Germain des Prés, where his best works are to be seen. These two memorials are to be raised by subscription, and the Emperor has headed each list with a donation of a thousand francs.—A statue of the naturalist, Daubenton, has just been uncovered in the Jardin d'Acclimatation in the Bois de Boulogne. Daubenton was a member of the Senate and of the Institute, professor of natural history, and member of nearly all the great scientific societies of Europe. France owes to him the introduction of the merino sheep. His remains are buried, according to his own desire, near the fine cedar of Lebanon, at the foot of the mound in the Jardin des Plantes, and a truncated column marks the spot.

Lyons Art Exhibition.—The exhibition of the Society of Friends of Art of the city of Lyons is announced to open on the 7th of January. The purchases at the last exhibition of the society amounted to about £2,300. The reception of works closes with the current month.

Exhibition of Old Faiences.—The town of Rennes opened an exhibition of French faïences on the 25th ult., which is to close on the 10th inst. The object, as expressed by the committee, is to institute a comparison between the various fabrics of the kind in France, and to elucidate the birth, apogee, and decline of this industry, to revive which great endeavours are now being made. An appeal was made to all persons who possessed specimens of the pottery of the 16th, 17th, and 19th centuries, and particularly for such pieces as bear signatures and dates, whether objects of ornament or utility. The undertaking is under the presidency of Dr. Aussant, who is an authority on French ceramic art.

Original Designs for Public Works.—It was the practice formerly of artists to give up to the authorities of the city of Paris the sketches of works executed, but from 1830 to 1863 this was not the case, and consequently the designs for the greater part of the Hôtel de Ville, and of other public buildings, by Ingres, Delacroix, Flandrin, Coignet, and other eminent artists, have been distributed. The municipality at present makes it an express stipulation that such designs and sketches shall become the property of the city, and intends to collect them together in a gallery. Such a collection will doubtless be highly interesting, but in some cases a great loss to the artist; the original designs by Eugène Delacroix sold for immense sums the other day, when his works were distributed by auction. The decision, however, may apply only to the finished drawings, and not to the rough drafts which are so much sought for by amateurs.

New Theatre at Palermo. — The authorities at Palermo have announced a competition for a new theatre, to contain three thousand spectators, and for which the sum of £100,000 has been voted. Five prizes are offered, varying in amounts from 25,000frs. to 2,000frs., and all the world is invited to compete.

Fine Arts in France.—Arrangements are being made in Paris for an exhibition of pictures exclusively of the German school. The Emperor has granted the sum of 15,000 francs (£600) for the completion of the exterior decorations of the museum at Orleans, which is installed in the house known as that of Diana of Poictiers.

Monument of Francois I. at Cognac.—This colossal group, in bronze, which M. Etex has had in hand for five years, was uncovered on the last day of October, in the presence of an immense concourse of people. The monarch to whom the monument is raised was born in the town of Cognac. The principal group represents Francis as conqueror at Marignan, at the moment when his horse is wounded by one of the Castillans, or mercenaries, whose sole duty was to disable the horses of knights and men in armour and bring the latter to the ground. The pedestal is composed of four immense blocks of marble, brought from Italy for the purpose; on its principal face, sculptured in alto-relievo, are two genii, supporting the arms of the hero, and resting on a battle-axe and a cassetête; on another face are the arms of the town of Cognac, and right and left of these are male and female figures occupied in gathering grapes for the vintage. The other sides are occupied by a bassi relievi in eight compartments, the subject being:—Louise of Savoie lying on the historic stone of the park, after having given birth to François, whom she called her Cæsar; François knighted by the Chevalier Bayard; the King sleeping on a gun carriage, his Italian trumpeter sounding the *réveil;* François in court dress giving audience and aid to artists and *savans* in the Palace of Fontainebleau, Leonardo de Vinci in the foreground; the field of the cloth of gold; Marguerite, his sister, visiting François when prisoner at Madrid; the citizens of Cognac refusing the ransom of the King to the envoy of Charles V., the Comte de Lannoy; François showing the tombs of Dagobert and Queen Nantchilde, in the church of Saint-Denis, to Charles V.

Statue of Claude Lorraine in Bavaria.—The young King of Bavaria has just had erected a monument in honour of the famous painter in the little chateau of Harlschug, where he resided for some years.

Manufactures.

Floating Storehouses for Inflammable Substances.—The accidents which have recently occurred with gunpowder and petroleum oils have induced the French authorities to establish a new system of storing such dangerous commodities. The method adopted is the construction of iron lighters, divided into proof compartments, and the isolation of these in rivers or basins. Two of these new magazines have just been launched at Saint-Ouen, between Paris and Saint-Denis, where an extensive commercial dock and entrepot have been established, and three more are under construction; each contains one hundred divisions, and each of the latter measures 25 tons in contents. The vessels are entirely of iron, but are covered on the deck and down to the line of flotation with wood, as a protection against changes of temperature. They are moored in the middle of a large basin, and can be swung round to the quay when required for loading or unloading.

New Mordant. — A new mordant, for aniline and other dyes, is said to have been discovered; it consists of acetate of aluminium and arsenitate of soda, and the discoverer, M. Schultz, believes that it is destined to replace albumen, gluten, tannin, and other matters now employed for the same purpose. He mixes, at the ordinary temperature, four grammes of the aniline violet of commerce, in powder, with a quarter of a litre of acetate of alumina, and twenty grammes of arsenitate of soda, thickening it with starch boiled in water—the quantity of starch to be diminished in proportion to the darkness of the colour to be fixed. In the case of prints, it is recommended to mix the arsenitate of soda and the acetate of alumina with the colouring matter, and to steam the fabric or yarns over the mixture. For dyeing, it is said to be better to treat the tissue, or yarns, in the first place, with a mixture of the two salts, and afterwards to dip them in the colour vat in the ordinary way. Salts or compounds of tin, combined with alumina, may be used instead of arsenical acid.

Discoveries in Electro-Plating.—M. Weil, a French chemist, announces a new method of depositing metals. The baths he employs consist of metallic salts or oxides in alkaline solutions by means of tartaric acid, glycerine, albumen, or other substances, which prevent the precipitation of the oxide by the fixed alkali, in some cases with and in others without the aid of zinc or lead, and at various temperatures according to circumstances. He claims also to be able, by like means, to give variety of colour to articles covered with copper by his process. M. Weil says that the most important application of his discovery is the deposit of copper and the bronzing of iron (cast as well as wrought) and steel, without the preparatory dressings with conducting substances, which are necessary in proceeding according to the ordinary methods before the object is placed in the bath and submitted to galvanic action. This, if it bear the test of practice, is a very important fact. Iron and steel thus coated with copper may, says M. Weil, be afterwards silvered or nickelised by his process.

New Blasting Powder.—M. Nabel proposes to make use of pyroglycerine (explosive glycerine) to increase the force of gunpowder for blasting purposes. It is said that experiments, made in the presence of a commission, prove that such a mixture is three times as effective as gunpowder alone. The cartridges made use of were of zinc; these were filled with gunpowder, and as much pyroglycerine was added as the powder would absorb. The detonation is said to be much less than that of gunpowder alone, but, on the other hand, the danger from accidental explosion is much greater, and, moreover, pyroglycerine is a powerful poison.

Iron Production in North America.—The value of the iron made in the States was estimated by the census returns at 20 million dollars in 1850, and 28½ million dollars in 1860, being an increase of 24 per cent. in the ten years.

Coal Production in the United States.—The coal production in the States in 1860 was 15½ million tons, of which 9½ millions was anthracite. Of bituminous coal Pennsylvania produced 45·8 per cent. of the quantity, and 38 per cent. of the value of the whole; of all kinds of coal, 75·3 per cent. of the whole.

California Silk.—The soil and climate of California are admirably adapted to the growth of the mulberry-tree in all its desirable varieties, to the breeding and feeding of the silkworm, and to the production of silk, more so than almost any European country, owing to the fertility of the soil and dryness of the climate, giving a peculiarly rich and nutritive character to the leaves of the mulberry tree, which imparts a higher, finer, and more delicate quality to the silk produced from them. Certificates from the highest authorities in Europe show that the California silk, after being tested, carefully analysed, and compared with European silk, proves to be of the very best quality.

Imperial Tokay.—The village of Tokay, which gives its name to the wine, is situated in Hungary, on the top of a hill, at the confluence of the rivers Rodrog and Theiss. The vineyards occupy a space of ten square miles. The earth is of yellow chalk, mixed with large pebbles. The wine is white, and the vintage is commenced as late in the year as possible, but generally at the end of October. There are four different kinds of Tokay. The first is made by placing the sound grapes in a wooden vat with a double bottom, the one on which the grapes rest being pierced with small holes. The vat is filled with grapes, and covered with boards. After a few hours, the grapes become heated to 80° Fahrenheit, and fermentation begins. This destroys the tartaric acid, and the weight of the grapes forces the juice through the holes at the bottom. The grapes are then trodden by foot, and the wine is poured into small casks, wherein, after having fermented for two days, it is exposed to the air for a month. This is the wine that is generally exported. When of good quality it has a silvery, oily colour. The taste is sweet and mellow, with a peculiar earthy flavour, slightly astringent and aromatic, with good body, but it is not drinkable until it is three years old. The Emperor of Russia has an agent who purchases 40 or 50 casks every year.

Colonies.

South Australian Copper.—The rapid progress of the Wallaroo mineral district furnishes the strongest arguments that can be desired with regard to the expediency of extending all possible encouragement to mining enterprise. It seems but yesterday that the whole country (now dotted with flourishing townships and supporting a population of thousands) was a waste and tenantless scrub, and the question that generally forces itself upon the mind is why should there not be a score of Moontas and Wallaroos developed. It is notorious that indications of copper abound in every direction, nor is it reasonable to suppose that the indications are all delusive. Perhaps no form of colonial industry is so generally beneficial as copper mining. A vast amount of labour must necessarily be employed, and the market thus created for every description of colonial produce is of immense importance to the farmer, stock-owner, and to the commercial public generally. There should be no restrictions, no difficulties, no impediments whatever. Every man should be free to search for copper, and any rental or other charge the state may think fit to exact should follow and not precede that search. If the prospector finds nothing the State should take nothing, and the most thoroughly liberal arrangements should be framed with a view to facilitate and encourage a description of enterprise of such unequalled benefit to the community. The total population of the Wallaroo district, so late an uninhabited desert, cannot be less than from 6,000 to 6,500 souls, as follows:—Kadina and Wallaroo miners, 2,200; Wallaroo, 2,000; Moonta and Moonta mines, 2,000; wood-cutters, carters, and others living in the bush, 300; making a total of 6,500 souls.

Phormium Tenax (South Australia).—Large quantities of this plant have been found growing on the mallee scrub of the Lachlan Plains. The flax is from three to four feet high, and from one to two inches broad. It is stronger in its fibre than the New Zealand plant, and seems to be exempt from those oily properties that render the latter so difficult to convert into useful purposes. It is believed that by the aid of the small steamers running up the rivers the South Australian settlers will be enabled to collect vast quantities of the article and send it up to Melbourne. Some specimens have already been forwarded for the purpose of being tested.

South Australia.—The great extent of the work yet to be accomplished in exploring the northern interior is shown by the frequency with which startling rumours relative to that part of the continent are received in Adelaide. Recently, much interest was excited by the report that a stockman in the employ of Messrs. Levi and Co. had discovered a large river flowing from a north-easterly district into Lake Eyre, a report which leads one to hope that the greatest problem of Australian geography has been solved, and that a question of the vast interior basin or inland sea in the north of Lake Torrens may at length be set at rest.

Obituary.

The Earl of Carlisle died, at his ancestral seat, Castle Howard, Yorkshire, on the 5th instant, after a protracted illness. He was the eldest son of George, sixth earl, by the Lady Georgiana Dorothy Cavendish, eldest daughter of William, fifth Duke of Devonshire. He was born in April, 1802, and educated at Eton, and Christchurch, Oxford, where he obtained both the Chancellor's prize for Latin verse, and the Newdigate prize for English verse, taking his B.A. degree in the highest honours. At an early age he entered Parliament as member for the borough of Morpeth, which furnished his own courtesy title. From 1830 till 1841 he sat as one of the representatives of the important constituency of the West Riding of Yorkshire. In October, 1848, he was removed to the House of Peers by the death of his father. Whilst holding a seat in the House of Commons, his lordship filled the office of Chief Secretary for Ireland from 1835 to 1841, under the Lord-Lieutenancy of the Marquis of Normanby and his successor, during a period of great excitement and difficulty; and it was whilst holding this office that he acquired that experience and popularity which rendered him afterwards so well qualified for the discharge of the viceregal functions. From 1846 to 1850 he was Chief Commissioner of Woods and Forests, and from the latter date to 1852, Chancellor of the Duchy of Lancaster. With the exception of the period of Lord Derby's second brief administration in 1858–59, the Earl of Carlisle held the Lord-Lieutenancy of Ireland from the month of March 1855, down to his retirement in September, 1864; a term almost unexampled in its duration. In that capacity he devoted much labour and pains to the development of the agricultural resources of Ireland, and to the spread of a general system of liberal and enlightened education. The noble Earl was the author of several works, of some reputation, the best of which are his "Diary in Turkish and Greek Waters," "Lectures and Addresses in Aid of Popular Education," and "A Lecture on Travels in the United States of

North America." Only a few months ago he presided over the proceedings at Stratford-upon-Avon, in commemoration of the tercentenary celebration of William Shakespeare. His lordship was elected a member of the Society of Arts in 1851, and served the office of Vice-President.

Publications Issued.

Picture Buyers and Amateurs' Guide, Theoretical and Practical, by Théodore Lejeune. (Paris: Benouard, three vols. 8vo.)—This useful and important work is the result of the long labour of a gentleman whose position and reputation give it special claims to attention. M. Lejeune is a painter, entrusted with the delicate duty of restoring the pictures in the Imperial galleries, public and private; and he is also conservator of the collections, amongst others, Duchâtel, Benoît, Fould, and Mornay-Soult. The object of the work, to quote M. Lejeune's own words, is to supply an exact classification of all true masters, in every style and of every school, together with an enumeration of their copyists and imitators, in order to assist amateurs in their researches. The first two volumes only have yet appeared; they contain an enormous amount of information, compiled by the hand of a master. The early chapters treat of general matters, such as the principles of the art, and its technology, the methods of recognizing copies, the fabrication of false pictures, the means employed for fixing the artistic and commercial value of pictures, and the various systems of restoration and cleaning in use; and, upon these points, the long experience of M. Lejeune, and the judicious and impartial tone of his remarks, render him an admirable teacher. In the body of the work the various schools are treated separately, and short, judicious appreciations given of each master, together with a list of his works, whether in public or private galleries, and the prices which they have fetched from the earliest known sales to the present time. The long lists of private collections in England evince the industry which M. Lejeune employed when visiting our country, the whole being furnished with an elaborate index of great importance. The third volume will include, amongst other matter, a Dictionary of Monograms, with fac-similes of a large number discovered or corrected by the author himself.

History of Inventors and Inventions. By Emile With, C.E. (Paris.)—The object of this little work is to inform inventors of what has been done, and to help them, if possible, to avoid wasting their time, energies, and money, in going over ground that has been beaten before. M. With has also his peculiar theories about the methods of assisting inventive spirits and rendering their inventions fruitful.

Observations Made at the Observatory of Paris during the Year 1863.—Such is the title of a publication just issued by M. Le Verrier, the Imperial Astronomer; it contains only the results of observations, their discussion being reserved for the *Annales* of the Observatory. It appears that the number of fundamental stars now registered amounts only to about 600. Great improvements are being made, not only in the means of observation, but also in the relations between the observatories of various countries; an agreement, for instance, has been made between M. Le Verrier and Professor Airy that the results of the labours of each shall be recorded in the publications of the other. The French *Bulletin Météorologique* has in the same spirit been re-named the *Bulletin International*.

Forthcoming Publications.

Les Bijoux et les Gemmes de la Collection du Louvre.—Etched by Jules Jacquemart, with explanatory letter-press, by Henri Barbet de Jouy, Conservator of the Musée des Souverains, and of the middle age and renaissance collections in the Louvre. The first portion of this interesting and important work will appear in February or March next. Everyone acquainted with the Louvre during the last ten years, will remember the little dark room in which were kept the vases in agate, rock crystal, jasper, sardonyx, lapis lazuli, and other stones; the chased and jewelled vases, cups, swords, and other curiosities which had been the property of the kings or queens of France, from the time of Childeric to that of Marie de Medicis. Two years ago this splendid collection was disinterred from the vault-like chamber, and arranged with the contents of the two above-named departments, the cups, vases, enamels, and other objects being admirably arranged in the magnificent Gallerie d'Apollon, which, for many years, had served no other purpose than that of a passage to the great picture-gallery. Here the beautiful works of the great artists of the Italian period, and the curious productions of their imitators, are seen to great advantage, and form one of the finest collections of the kind in Europe. Monsieur Barbet de Jouy, the keeper of this portion of the collections in the Louvre, is now engaged in the production of a catalogue of the contents of these galleries, which will shortly be ready. The forthcoming work, to which this notice alludes, will be no catalogue, but a collection of etchings, representing about one hundred of the rarest or most beautiful objects in the two collections—arms, vases, crystal cups, coffers, reliquaries and ornaments illustrative of industrial art from the earliest days of the French monarchy to the time of Louis the XIV. inclusive, each plate being accompanied by historical and technical notes. The latter will be from the pen of M. Barbet de Jouy, whose reputation and position give them special value; and the former are the work of M. Jules Jacquemart, one of the most able of the French *aquafortistes*. This young artist has already achieved a high reputation by his illustrations of his father's work, "The History of Porcelain;" of the elegant publication of the house of Techner and Co., of Paris, "The History of Bookbinding;" and by some charming fugitive productions of various kinds. We have been favoured with a sight of the plates already executed, and of the drawings for others, and we have certainly never seen more brilliant effects in black and white than those which M. Jacquemart has succeeded in producing in his reproduction of some of the crystal objects submitted to his pencil. Colour is not amongst the means employed, and therefore the etchings in question cannot supply the million with representations, *fac-similes* of the curious objects in question, but the artistic eye will revel in these etchings, which not only reflect the spirit of the great artist workmen of the middle ages, but fix on the plate the beautiful effects of light playing on surfaces of the most complicated outline in an extraordinary manner. The first part of this work, which will consist of three livraisons, will contain thirty-two plates, and as many sheets of descriptive history, and will include, amongst other subjects:—the sword of Childeric, with the crystal ball which accompanies it, and which is supposed to have been used by the Merovingian monarch, as eastern potentates still use similar balls, to produce a pleasant sensation of coolness to the hand; the vases of St. Louis; the sword of Charlemagne; the vase of Aliénor, queen of Louis VII.; the agrafe of the royal mantle of Saint Louis, an immense diamond-shaped clasp or brooch, weighing at least two pounds, and decorated with precious stones apparently of great value; and several other interesting objects. An attempt to delineate gold, silver, and gems by means of the etching point, seems, at first sight, as hopeless as painting the rainbow in Indian ink, but for all purposes of art, M. Jacquemart's etchings are true and admirably effective; as a French critic said of our Turner, "he has tried to paint *light* and has very nearly succeeded."

Notes.

Killing Animals Without Pain.—Dr. Mac Cormac, of Belfast, writing to the *Northern Whig* on the painless extinction of life in animals designed for human food, proposes carbonic acid gas as a suitable agent for this purpose. His method would be extremely simple, and certainly would be an immense improvement on our present practices, which are still as barbarous as they were in the darkest ages. A carbonic acid gas generator of suitable dimensions, fed with a little chalk and sulphuric acid, must be had to hand. The sort of generator made use of by the soda water manufacturers would answer every purpose, even on the largest scale. The gas might be conducted by a pipe or duct into a wooden reservoir or chamber, for carbonic acid gas is so much heavier than air, where the animals should be led. Even gas mixed with air would suffice. No sooner should the line of the gas rise above the level of the zone of respiration than as in the case of the *Grotto del Cane*, or the brewer's vat, the animal would at once fall prostrate and insensible, and, without experiencing any appreciable pain or suffering, expire. A sort of India-rubber hood or bag could otherwise be adjusted to the creature's head, and, when so adjusted, the gas might be led on by a treddle pressed by the operator's foot. The instant the gas should surround the respiratory outlets, the animal's consciousness would cease. In order to prevent reanimation, the creature would have to be left a few minutes untouched, after which the butcher might resume his functions. Some persons may, perhaps, entertain an objection to the flesh of animals that have not been bled. But the abstraction of the blood, if desired, may as readily be effected after death by this process as when it is taken away in the usual manner. But the doctor strongly urges the discontinuance of the blood loss altogether. The butchers' prejudice about well-bled meat is one which they have imbibed from their superiors, and has no colour of support, Dr. Mac Cormac maintains, whether in reason or fact.

Parochial Industrial Exhibition.—The clergyman of Amberley, near Stroud, the Rev. R. Edward Blackwell, is actively engaged in getting up an industrial exhibition among his parishioners, and he explains his scheme in a letter addressed to them, from which the following extracts are made:—"You all know how many evils and how much unhappiness, idleness, during the hours of a winter evening, too frequently leads to. That person, then, is your friend who will suggest to you any occupation which may amuse you—which may put some money into your purse—which may keep you at home, and which, in many other ways, may indirectly be for your good. Many of you are clever in making certain things; one can do one thing, and one another. If you will only try, you will find that you can do many more things than you think you can. This trying will be very useful to yourself and others, for one person working will soon set another person a-going. My plan, then, is to try and set all of you, men and women, boys and girls, to work in a pleasant way in your own houses, at your odd moments, during this winter, and for you to gain something by it. At some suitable time in the spring I should like to have in our school-room what we may call an 'Industrial Exhibition.' During the winter months I would have you all work for this, according to your own different tastes and powers, one making one thing, and one another. Everything you make will be your own. At the time fixed for the exhibition, I will endeavour to gather together our friends throughout the neighbourhood, and sell for you the things you have made, if you wish them to be sold. I do not promise to sell them, but I will try to do so; if we cannot sell them they will be returned to you. Every article exhibited, I would suggest, should have the name of the maker written upon it, so that your friends will see by whom every article is made. Let me mention certain things which one and another of you can do, or make, and which I have seen you at different times doing and making as I have called in at your houses:—Baskets—all sorts, all sizes, made of anything, for workmen to carry their meals or their tools in, or for anything else. Work in straw, or rush, or willow, or fern, or grass—mats, house-maids' kneelers, flower pots, bee-hives, cradles for babies or dolls, &c. Rustic seats, small and large—garden tables, stands for flowers, &c. Models—any kind, of any thing. Works in wood—picture frames, towel-horses, cap-stands, boxes, knife-trays, washing-stands, wheel-barrows, rough and smooth, large and small, &c. Works in stone, carved ornaments, vases, flower-pots, sun-dial stands, &c. Needlework—all kinds, patchwork quilts, bags, garden bonnets, knitting, netting, knotting, anything. Birds stuffed—collections of insects, &c. Turning—any thing useful, pegs for hats, for door handles, and for tobacco stoppers. Sticks for tying flowers to—bundles, in dozens, of hazel sticks, or neatly split wood, or turned wood. Labels for flowers in dozens; little boys might make these. Odds and ends—bits of cloth made useful, boys' caps, easy slippers, table covers, shoes made somehow and with anything, drawings, children's toys, dolls, small wheel-barrows, fossils collected from quarries and cleaned, glass covers for flowers, collections of different mosses, or winter flowers in pots or dried, &c., &c." He then suggests a committee of parishioners, and goes on to say—"If the committee see many working, and the thing likely to be a success, they would, previous to the exhibition, print a catalogue of the principal articles about to be exhibited, with the names of the makers. In certain cases the committee might lend a few shillings to buy wood, locks, or other things, as might be required, to be repaid when the articles were sold. The exhibition must be strictly confined to persons living in the parish of Amberley, or to those who belong to the Amberley church or schools. Every article exhibited must be made entirely by the person who sends it. Combined with the industrial exhibition, I would suggest that any friends who have objects of interest to exhibit should be requested to lend them for public exhibition on this occasion; the one exhibition would thus add interest and give power to the other. The exhibition to be open two or three mornings and evenings. The Amberley 'Industrial' band will attend, when able. None of the things sold to be removed till the exhibition is over. Such, dear friends, is a rough plan of my scheme. I am sure it would answer, and do good, if you would all, big and little, men and women, only try to do your best. Let everybody make a something, however small or simple. Do not be shy, or hesitate to join our band of workers. Let every person in the parish if possible be an exhibitor, and try and make something which will do him credit. Great moral benefits must result if we endeavour to spend our winter evenings in a profitable way. Let us look upon this effort in this light; let us all remember the end we have in view; let a family work together in common, and it must produce family love and union. The hearts of the fathers will be turned towards their children. If a small sum of money could be raised, we might bestow a few presents on those amongst our poorer friends, where industry and ingenuity had been manifested, and where there had been persevering effort, amidst poverty and difficulty."

Correspondence.

Statues of Eminent Men.—Sir,—What has the Council done with the Committee on this subject? I hope the Committee is to be re-appointed, and that the following extract from the *Times*, of November 20th, will be read by it. The Thames embankment will afford even a finer sight than a boulevard for an avenue of

statues, and I suggest that the council put themselves into communication with the Metropolitan Board of Works:—"It is true that no city in the world has undergone such transformations as Paris for the last ten or twelve years. Streets of portentous length have been cut through masses of masonry, old or new, as they happened to be in the way, laid bare recesses the very existence of which had been almost unknown to the ancients of the other quarters, and penetrated into alleys and winding lanes, the abode of pestilence and crime, and through which light and air had never filtered. Fountains, gardens, and squares stand where only a few years ago no human habitation was seen. This is not enough. What has hitherto been done is but the solid portion of the monument which is meant to perpetuate the memory of Napoleon III.—the mere masonry, the grosser part of the design. Stately mansions have arisen, as if by magic; there is a very wilderness of boulevards; sewers run in all directions underground; squares are planted with trees; and masons, blacksmiths, carpenters, &c., have done their best. The substantial and the useful being now so much advanced the moment is come for the ornamental, and when the mechanic must give way to the artist. People talk of a double road of statues starting from the Place du Trône, traversing the Boulevards and the Champs Elysées, and terminating at the triumphal arch of the Place de l'Etoile; that is, from one extremity of Paris to the other. Those statues, in marble or in bronze, are to reproduce all that was most celebrated in Monarchical, Republican, and Imperial France, so that in this open-air museum the French may see at a glance all that their country has produced of what was glorious in war, in letters, and in the arts; and that the very omnibus drivers and hackney coachmen may read as they run the lives of these worthies."—I am, &c., F. S.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Arts, 8. Cantor Lectures. Mr. B. Waterhouse Hawkins, "On the Reproduction of Natural Forms by Art and Manufacture." Introductory Lecture.
R. Geographical, 8½. 1. Mr. John Cameron, "On the Islands of Kalatoa and Paloweh, Malay Archipelago." 2. Dr. J. Hector, "Expedition to West Coast of Otago, New Zealand." 3. Mr. Albert Walker, "Journey along the West Coast of Middle Island, New Zealand."

Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion upon Mr. Taylor's paper "On the River Tees."
Zoological, 9.
Syro-Egyptian, 7½. Mr. S. Sharpe, "On the Ground Plan of the Temple at Jerusalem."
Ethnological, 8. 1. Mr. Laing, "On certain Remains of the Stone Period from Caithness." 2. Professor Huxley, "On the Human Remains collected by Mr. Laing." 3. Mr. John Evans, F.R.S., "On Flint Implements from Salisbury Hill, near Bath."

Wed. ...Society of Arts, 8. Sir Robert Kane, F.R.S., "On the Recent Progress and Present State of Industry in Ireland; and the Dublin International Exhibition of 1865."
Graphic, 8.
Microscopical, 8. Discussion on "The most Advantageous Means of Illuminating Objects under the High Powers of the Microscope."
Literary Fund, 3.
Archæological Assoc., 8½.

Thurs...Royal, 8½.
Antiquaries, 8.
Linnæan, 8. 1. Dr. Kirk, "On the Tsetse fly of Tropical Africa." 2. Dr. Hooker, "On *Aristolochia*, *Hydnoria*, and *Apodanthes*." 3. Dr. Dickie, "On two forms of *Eriophorum angustifolium*." 4. Professor Oliver, "On *Lentibulariæ*, collected in Angola by Dr. Welwitsch." 5. Prof. Oliver, "On Plants collected in Japan and the Islands of the Korean Archipelago by Mr. R. Oldham."
Numismatic, 7.
R. Society Club, 6.
Chemical, 8. 1. Messrs. Gladstone and Holmes, "Action of Ammonia on Sulphochloride of Phosphorus." 2. Prof. Williamson, "Chemical Nomenclature and Notation."

Fri.......Philological, 8.

Patents.

From Commissioners of Patents Journal, December 2nd.

Grants of Provisional Protection.

Benzole, treating of—2846—J. J. Moutie.
Bodily injuries, appliances for treating—2842—M. Henry.
Boilers, manufacture of wrought-iron—2834—R. Gardner.
Cages—2812—C. Mohr and S. E. Smith.
Cannon, breech-loading—2153—J. H. Wilson.
Carpets, looms for weaving—2848—P. Lachez.
Cocks and valves—2836—R. Harlow and W. Jolley.
Corn, millstone for grinding—2862—J. Aubin.
Envelopes, mechanism for closing—2820—W. Fisher.
Filter or press—2786—W. E. Newton.
Fire bars—2860—J. Gothard and H. Garland.
Grain, receptacle for storing—2844—A. C. Henderson.
Gun barrels and ordnance—2784—J. Thompson.
Gunpowder, machinery for compressing—2816—D. S. Sutherland.
Hair, apparatus for brushing the—2838—C. L. Oliver.
Hats, &c., manufacture of—2790—R. B. Cooley.
Invoice file—2780—S. Dixon.
Iron and steel, manufacture of—2856—S. C. Kreeft.
Knapsack supporter—2818—G. Davies.
Looms—2850—J. Bullough.
Looms—2804—W. Clark.
Malt liquors as tonics—2821—F. A. Papps.
Manure, manufacture of—2840—J. J. Renous-Cere.
Meat, &c., preserving—2794—J. McCall and B. G. Sloper.
Metals, rolling—2772—A. Bechem and H. Wedekind.
Millstones, apparatus used for feeding—2824—E. F. Woods and J. S. Cocksedge.
Motive power engines—2796—J. Simes.
Moulds for casting—2810—W. E. Gedge.
Night lights, manufacture of—2762—A. Field.
Painting, composition for—2858—M. Destrem.
Paper, manufacture of—2798—L. Cooke.
Photography—2800—W. Willis.
Pins, pointing wires for—2540—O. L. Hopson and H. P. Brooks.
Printer's ink, manufacture of—2854—J. Rowley.
Pumps, apparatus for working ships'—2814—C. W. Heckethorn.
Pumps—2830—W. E. Gedge.
Railway breaks, management of—2618—H. Bird.
Railway trains, communication between passengers and guard—2826—C. Cotton and W. Nunn.
Running shafts, lessening the resistance to the motion of—2843—N. Bailly, C. Durand, G. H. Mesnard, and Z. Poirier.
Saws, sharpening—2793—E. J. W. Parnacott
Sewing machines—2822—J. McCloskey.
Soda, manufacture of—2864—W. E. Newton.
Steering apparatus—2792—M. W. Ruthven.
Substances containing moisture, apparatus for drying—2806—G. Smith.
Sugar, mills for crushing—2802—G. Dixon.
Ventilators, apparatus for cleaning—2009—H. Dyer.

Inventions with Complete Specifications Filed.

Lamps, burning oil in—2939—W. Ryder.
Tanning, process of—2927—F. Pfanhauser.

Patents Sealed.

1387. B. Azulay.
1391. E. Ledger.
1392. J. Smith.
1393. W. T. Cheetham.
1396. H. Hill.
1398. J. Snider, jun.
1400. B. E. M. Crook.
1408. W. Clark.
1409. E. J. Hughes.
1417. J. A. Wade.
1419. A. A. Larmuth.
1428. A. Tweedale.
1431. P. M. Parsons.
1438. N. Sarony.
1455. E. G. Fitton.
1462. R. Kendrick.
1475. M. A. F. Mennons.
1504. R. and L. R. Bodmer.
1508. M. E. Boura.
1645. A. Wyley and J. Grainger.
1692. C. H. Collette.
2364. H. Bennison.
2429. S. Bateman.

From Commissioners of Patents Journal, December 6th.

Patents Sealed.

1414. R. A. Brooman.
1434. J. Onions.
1440. F. Tolhausen.
1441. W. Hugo and A. Domerer.
1442. J. P. Williams and T. Robinson.
1444. R. A. Brooman.
1449. S. Tuchet.
1452. P. and J. B. Spence.
1463. J. G. Marshall.
1520. J. H. Johnson.
1522. S. G. Hewitt.
1548. J. H. Johnson.
1629. R. Balans.
1769. W. K. Westley.
2064. G. Davies.
2246. G. Haseltine.
2396. G. Haseltine.
2397. G. Haseltine.
2569. J. Zeh.

Patents on which the Stamp Duty of £50 has been Paid.

35. H. D. Pochin.
3031. G. T. Bousfield.
3332. J. L. Field.
3033. W. Duchemin.
3025. T. W. G. Treeby.
3066. J. J. Russell and B. L. Brown.
3098. W. E. Newton.
3257. W. E. Newton.
3048. J. Knowelden.
3055. M. Henry.
3069. R. Jolley.
3235. R. Needham.

THE

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AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, DECEMBER 16, 1864. [No. 630. VOL. XIII.

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Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

DEC. 21.—The Articles sent in Competition for the Art-Workmanship Prizes will be Exhibited; and a short Review of the Society's past and present action in the Promotion of Industrial Education, by S. T. DAVENPORT, Esq., will be read.

CANTOR LECTURES.

"ON THE REPRODUCTION OF NATURAL FORMS BY ART AND MANUFACTURE." By B. WATERHOUSE HAWKINS, Esq., F.G.S., F.L.S.

DEC. 19.—LECTURE II.—Demonstrations of the unity of plan in the external forms of animals, the just appreciation of which facilitates the work of the artistic producer, and adds to the enjoyment of the intelligent possessor of works of art.

JAN. 16TH, 1865.—LECTURE III.—On the varieties of artistic treatment of the forms of animal and vegetable life—pictorial representation; conventional ornamental, allegorical, and symbolic combinations of animal forms.

JAN. 23RD.—LECTURE IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

JAN. 30TH.—LECTURE V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. A set of tickets for this purpose has been sent to every member.

Proceedings of the Society.

CANTOR LECTURES.

"ON THE PRODUCTION OF NATURAL FORMS BY ART AND MANUFACTURE." BY B. WATERHOUSE HAWKINS, ESQ., F.G.S., F.L.S.

FIRST LECTURE.—MONDAY, DEC. 12.—INTRODUCTORY.

MR. WATERHOUSE HAWKINS delivered the inaugural lecture of his course in connection with the Cantor Series of the present session. The subject to which he especialy desired to direct attention was the application of natural forms to Art and Manufactures. In his introductory remarks he referred to the greatly advanced appreciation of Art by the English people since 1851, and pointed out the educational advantages which had resulted from the Great Exhibition, by the establishment of a National Museum of Art Industry at South Kensington, a collection in connection with which the Government Schools of Design were established, and which, in its intrinsic merit and arrangement, was unequalled by any other similar museum in Europe. Notwithstanding the improved appreciation of Art by the public, and the advantages which existing Art collections afforded to the student and workman, he nevertheless deplored the inability of the English artist to produce designs suited to the requirements of the British manufacturer, equal to those produced by the foreign designer and artist—this was particularly evidenced by the fact that in the Exhibition of 1862, nearly every important work exhibited by our great Art-Workmanship manufacturers had been produced from the design of some foreign artist. He then proceeded to discuss the reason of this deficiency of the English artist, and stated that he considered it resulted from the nature of the training to which Art-students were subjected in England, as compared with the system pursued in continental countries. In England the Art instruction tended to create skillful copyists, great precision, and steadiness of hand in the use of the pencil, but at the same time crippled the mind, whereas on the Continent the student was taught to take broad views of

Art by observing the structural forms of objects in nature, a system which left the mind and hand much more free. He believed that the Englishman's impediment was not a want of material in which to produce, nor yet examples to study, but resulted from a heavy drill, which created good imitators, but did not tend to create inventors. In order to invent or create successfully good designs for the Art manufacturer, it was necessary that the artist should possess a thorough knowledge and appreciation of the structure of natural objects, without which knowledge it was impossible for the draftsman to adapt the frames of men or animals to the requirements of the ornamentist and the processes of production, and ornament, if produced without a knowledge of structure, inevitably resulted in imperfect drawing or unnatural distortions. He then proceeded to point out that one universal law of structure pervaded the whole of the animal kingdom, a knowledge of which enabled the designer to correctly represent and apply the conception of his mind to the ornamentation of matter; and, by means of diagrams which he drew upon the black board, showed that man in an erect position could readily be made to represent a lion, as commonly drawn in Heraldry, stating at the same time that, structurally, the two were identical. He then referred to the importance of natural history museums in an Art point of view, and called attention to the method employed by Mr. Waterton of preserving skins of birds, animals, and reptiles, by the use of corrosive sublimate dissolved in spirits of wine, and urged the importance of natural forms being preserved truthfully in an artificial state, as otherwise the specimens tended to mislead the student rather than to instruct him in the flowing lines and graceful forms so commonly to be found in the animal kingdom.

Fifth Ordinary Meeting.

Wednesday, December 14th, 1864; Lord Dufferin, K.C.B., in the chair.

The following candidates were proposed for election as members of the Society:—

Bayley, John C., 1, Park-place-villas, Maida-hill, W.
Buxton, William, Lime-tree Lodge, Rotherhithe, S.E.
Hancock, Henry J. B., Duke's-hill, Bagshot.
Knight, John Peake, South Eastern Railway, London-bridge, S.E.
Lowe, John Stanley, 31, Cornmarket-street, Oxford.
Melliss, George Whalley, 17, Talbot-terrace, Westbourne-park, W.
Parnell, Hugh, M.A., 3, New-square, Lincoln's-inn, W.C.
Strachan, Charles Henry, 51, King's-road, Camden-town, N.W.
Vincent, Henry, 28, Mornington-crescent, N.W.

The following candidates were balloted for and duly elected members of the Society:—

Barnes, Joseph, 5, St. Thomas'-street, Borough, S.E.
Batson, John, 42, Brewer-street, Golden-square, W.
Dear, Alfred, Pavilion, Belgravia, S.W.
Dear, Arthur, Pavilion, Belgravia, S.W.
Forristall, Michael, The Hermitage, Forrest-hill, S.E.
Grundy, John, The Middle Temple, E.C.
Hall, J., 29, Warwick-square, S.W.
Huth, Edward, Oakfield Lodge, Huddersfield.
Lane, William James, 5, Studley-villas, Studley-road, Clapham, S.
Lord, James, St. John's Lodge, Wandsworth-common, S.W.
Monteith, James, 38, Duke street, St. James's, S W.
Moss, William H., 19, Parliament-street, Hull.
Rochussen, Theodore Anthony, 9, Friday-street, E.C.
Saunders, Edwin, 13*a*, George-street, Hanover-square, W.
Schweizer, J. J., 28, Poole street, New North-road, N.
Scott, Rev. C. B., 19, Dean's-yard, Westminster, S.W.
Turner, Henry, St. Joseph's road, Higher Tranmere, Birkenhead.
Twentyman, William Holme, Manor-hill, St. John's-wood, N.W.
Vaudrey, Henry, 10, Norland-square, Notting-hill, W.
Walker, G. H., Rugby.

The following Institutions have been taken into Union since the last announcement:—

Knutsford, Penny Readings.
Preston, Institution for the Diffusion of Knowledge.

The Paper read was—

ON THE RECENT PROGRESS AND PRESENT STATE OF INDUSTRY IN IRELAND; AND THE DUBLIN INTERNATIONAL EXHIBITION OF 1865.

By Sir Robert Kane, F.R.S., President of Queen's College, Cork, and Director of the Museum of Irish Industry, Dublin.

At the request of the Executive Committee of the Industrial Exhibition, which is to be held in Dublin in the summer of next year, I have undertaken to bring under your notice this evening some explanation of the circumstances under which that Exhibition has been undertaken, and the arrangements which have been made to secure its success, together with such notice of the present position of Ireland, in an industrial point of view, as may enable the members and visitors of this Society, representing as they do so fully the industrial intelligence and commercial energy of this country, to judge whether the objects for which we in Ireland are now labouring are worthy of that sympathy and co-operation which I trust we shall be able to obtain. Almost simultaneously with the earliest efforts of this Society, to realise, by means of exhibitions, the actual position of British industry, similar exertions were made by those in Ireland, who were anxious to direct the energies of that country to the permanent and solid advantages of industrial pursuits; and amongst the means employed for that useful purpose, exhibitions of manufactures held a prominent place, these, although necessarily of a local and limited character, obtained a large amount of popularity and success. All such exhibitions, however, whether held here or in Dublin, could be considered but as the faint glimmerings of dawn heralding the full refulgence of the day when under the august Prince, whose loss the friends of intellectual and industrial progress will always deplore, the Exhibition of 1851 was inaugurated, and that unparalleled review of the aggregated productive forces of the world was opened to the assembled nations. The impetus thus given led to a greater development being allowed to the Exhibitions which took place in Ireland immediately after, as in Cork in 1852, and especially in Dublin in 1853. The objects were no longer limited to Irish manufactures, as they had previously been, but the British and foreign manufacturers were invited, to render the Exhibition in Dublin, as in London, really international. The Dublin Exhibition of 1853, for which a building admirable in its adaptation had been provided by the liberal enterprise of Mr. Dargan, was remarkable for the introduction of Fine Arts as a leading department, and was honoured by the presence and approval of Her Majesty the Queen and her illustrious Consort.

The great International Exhibition of 1862, which, after the interval of eleven years, had renewed with still greater richness and completeness of illustration the glories of 1851, had naturally suggested that after a similar interval an International Exhibition should be held in Dublin. It may be stated that an Exhibition has this year been held at Dublin and attained considerable popularity. Being limited, with the exception of machinery, to the display of objects of Irish manufacture, this Exhibition was on too small a scale to represent in any

degree the progress which foreign and domestic industry has made within the last ten years.

The opportunity of which it is now proposed to make use, in order to organize in Dublin an International Exhibition, which shall be the worthy successor of the great successes of 1851, of 1853, and of 1862, has arisen from the fact that a number of gentlemen, of whom it is only necessary to mention the names of the Duke of Leinster, of Mr. Guinness, and of Mr. Dargan, possessing at once the inclination and the power, have undertaken to provide for the citizens of Dublin a great winter garden and buildings containing concert and lecture rooms, supplying, but on a smaller scale, the resources and enjoyments of the Crystal Palace at Sydenham. An independent Executive Committee having been formed to organise and carry out an International Exhibition, the Directors of the Winter Garden have most liberally placed their fine buildings altogether at the disposal of the Committee for that purpose, and the Executive Committee have gladly availed themselves of this truly patriotic proposal. The Exhibition will, therefore, be organised under extremely favourable conditions, as all that in other previous occasions had entailed the greatest amount of expense, of responsibility, and of risk, will have been spontaneously and all but gratuitously provided, whilst the authority and direction is preserved entirely in the hands of the Executive Committee. The great advantage which will thus naturally result to exhibitors in the arrangement of their articles will be easily understood, and it has been arranged that all funds arising from the receipts above the payments of the expenses incidental to the Exhibition, shall be vested in a Committee of noblemen and gentlemen, under whose direction the excess shall be applied to public purposes for the advancement of Arts and Sciences in Ireland.

Such being the circumstances under which the proposed Exhibition is to take place, I shall very briefly notice the position which the building occupies. It is situated on the south side of Dublin, and in what may be considered the most fashionable quarter of the city; close to the terminus of the railway which leads to the beautiful mountain scenery of Wicklow. The extent of space accommodation available may be found in detail by reference to plans which are in the office of this Society, but I need only say that the accommodation already at their disposal is very large, and there are, as I believe, now present, gentlemen representing the Committee of Advice and the Executive Committee who will be able, and I am sure willing, to supply information as to the details of space, much more precisely than I could attempt to do. The principal portions of the Exhibition will be located in the Great Conservatories of the Winter Garden,—constructions in glass and iron, rivalling the Crystal Palace itself in elegance of design, although of course much inferior in extent, and affording advantages as to supply of light and means of display which could not be surpassed.

Under those favourable circumstances it may be hoped that, not merely on public grounds, but even on the lower but more directly practical basis of individual advantage, we may hope for the co-operation of the manufacturers of Great Britain, who cannot fail to derive material benefit from bringing the products of their factories and workshops under the immediate cognizance of the Irish people. The Executive Committee have good grounds for expectation that the industrial resources and products of our Colonies and of the European Continental States, with scarcely an exception, will be adequately represented on that occasion. Gentlemen of great activity and intelligence have visited, on the part of the Executive Committee, the governmental authorities and the industrial centres of the Continental States; they have been uniformly received in a most friendly spirit, and have received promises of active co-operation. We shall thus have brought before the inhabitants of Ireland the most beautiful and perfect productions of the industrial enterprize and artistic genius of Italy, of France, of Germany, and of Belgium. We shall have, as I expect, very efficient evidences of what Ireland itself can do in the way of manufactures; and it is to be hoped that the British manufacturers, even satiated as they may well be with triumphs already gained, and somewhat fatigued from the exertions by which that success was earned, will still not allow an International Industrial Exhibition to take place without Great Britain being properly represented, the more when that Exhibition will be held under the august sanction of Her Majesty the Queen, who has most graciously been pleased to become its patron, and when the Executive Committee have reason to expect that the Exhibition will be honoured by the presence of their Royal Highnesses the Prince and Princess of Wales.

Among the elements of success to which the Executive Committee attach the greatest value, must be considered the support and co-operation which has been received from the Council and officers of this Society. By their assistance a London Committee of Advice has been formed, which has contributed materially to our success. The all-pervading and well-earned influence of the Society of Arts throughout the manufacturing world secures to its recommendation, or as I may say, to its endorsement, an attention that no other body could command; whilst the accumulated experience of its officers in everything connected with the organisation and management of Industrial Exhibitions has even already proved of the utmost value. The Members of the Executive Committee are therefore anxious that I should express how deeply they feel the benefits of the advice and assistance they have received from this Society.

Whilst making the arrangements which I have endeavoured to describe for procuring a full and satisfactory representation of the natural resources and industrial progress of our colonies and of foreign states, the Executive Committee has had its attention naturally directed to the position which the productions of their own country should occupy in the Exhibition. Two courses were open to them—the one, of carrying out the principle of geographical classification, which will be adopted as regards the colonies and foreign countries, and thus to arrange the manufactures of Great Britain and of Ireland separately; or on the other hand, to merge all separate insular existence, and exhibit under one head the industrial productions of the United Kingdom. Although the former plan might have tended to conciliate to the undertaking a good deal of local feelings and honest prejudices, the Executive Committee have decided upon adopting the other course, and propose to arrange that all natural and manufactured products of Ireland shall fall into their respective positions as elements of the great total of British industry, extending to the results of industry—that fusion of interests and of objects which has already made so much progress in the political and social relations of those two countries.

In taking this course, however, the Committee are quite sensible of the risk that the industrial productions of Ireland—which are so limited in amount and in variety, as compared with those of Great Britain—might easily be lost sight of, and pass unnoticed in the immensity of the results displayed by her more fortunate Sister; and that, although acting upon the purest motives, and taking a course which I am sure will be found to be correct, they might be the innocent means of an injustice being done to the manufacturers of their native land. This it is desirable to prevent, and hence I feel it my duty in this paper, which may be considered as in some degree a foreshadowing of the Exhibition which is to come, to supply a notice of the present condition of manufacturing industry in Ireland, not attempting to go into details, or to mention every department, but only such as may furnish an idea of what is being done, and what we may hope to be able to do in the way of successful manufactures.

Every person is familiar with the fact that—whilst in this country the great development of manufactures forms the characteristic of its social organisation and the foundation of its political strength—in Ireland the manufacturing industry has not attained any similar extension, and that agriculture, generally speaking of an imperfect kind, forms the principal means of occupation and of existence to the people. Hence the terrible results which followed from the potato disease, and consequent famine in the years 1845–46, by which not less than a million and a half of population was destroyed, and which, followed by a continuous stream of emigration, numbering not less than 80,000 a year, reduced the population of Ireland from 8,175,124, in 1841, to 5,798,967, in 1861. I do not feel called upon, or indeed here even authorised, to express an opinion as to how far this great diminution of population is to be regarded as a national misfortune or the reverse; it is impossible, however, not to recognise that, under at least two points of view, society has benefited by the changes thereby introduced: Firstly, the establishment of the Incumbered Estates Court, by which the position of landed property has been simplified, and the introduction of an improved system of agriculture facilitated. Secondly, the rate of wages has been very materially increased, and payments in money generally substituted for a complex system of allowances, which practically left to the agricultural labourer little beyond the mere permission to live.

A population thus specially devoted to agriculture in its simplest form can turn only with difficulty, and under great stimulus, to manufacturing operations, so much more complex in their nature, and requiring so much more of intellectual exertion for their successful prosecution. In fact, even in England the first introduction of the staple manufactures had been mainly due to the successive waves of foreign population, Flemings, Germans, and French, who, retiring from the political and religious persecutions to which they were exposed in their respective countries, sought the safety and refuge which England alone, then even as now, presents to all that peaceably land upon her shores. To the philologist a curious study is afforded in the technical expressions still employed in the every-day language of the English workman in various manufactures, marking the foreign origin of those trades, and even the time and circumstance of their importation.

Similarly in Ireland we were indebted principally to strangers for the introduction of those branches of manufacture which were subsequently carried on with most success; and in many cases the names most eminent, even at the present day, among our mercantile community, mark unmistakeably the historical events which had deprived their native countries of the ancestors of such worthy sons.

The absence from Ireland of any abundant deposits of bituminous coal, such as occur in this island, and on which gift of nature has been built up the colossal fabric of England's industrial power, necessarily prevents the establishment in that country of those branches of trade in which the cost of fuel forms any very large proportion of the total cost of production. Hence, although possessing in abundance deposits of the richest iron ores, we have not had any successful establishment of iron smelting in recent times. The iron ores, however, both as earthy carbonate and as hematite, are now largely exported from Ireland to this country to supply the enormously-increased demand. Similarly, although large quantities of copper ore are raised in Ireland, principally in the southern counties of Cork and Waterford, the ore is shipped to Swansea to be smelted, as the large proportion of fuel which is required in smelting copper would render the progress in Ireland too costly to be profitably carried on.

In the case of the ores of lead and silver, however, the proportion of fuel necessary is not so large, and not merely are all the lead and silver ores raised in Ireland smelted in the vicinity of Dublin, but a large quantity of foreign ores of those metals are imported for Irish smelting works, the produce from which is highly esteemed, not merely in the local but in the British markets. I believe that this department of mineral industry will be found very efficiently represented by Irish smelters in the coming Exhibition.

Although the smelting of iron ores and the actual manufacture of iron is not now carried on in Ireland, yet there is a very large amount of trade in the making of machinery, especially for the linen manufacture, of steam engines and water-wheels, and of late years of iron ships. This latter business has already assumed large proportions. The Messrs. Harland and Wolff, of Belfast, have built in the last ten years twenty vessels, of an aggregate tonnage of 36,913 tons, giving employment to about 1,200 men. The establishment of Messrs. Malcolmson, at Waterford, is similarly active, and employs about 300 men, turning out annually, at least, one first-class steamer, mostly above 2,500 tons burden each, and engaged in transatlantic voyages. The establishment of Mr. Pike, in Cork, is equally successful; whilst that of Messrs. Walpole, Webb, and Bewley, of Dublin, although only two years in existence, already gives employment to about 600 hands, and has completed five vessels, of which one of 1,434 tons burden, the *Knight Commander*, was almost the only ship that rode out uninjured the terrific cyclone that recently caused such frightful calamity at Calcutta. I mention these particulars to illustrate how much of industrial activity there already exists in Ireland, and how marked the extension of that activity in certain departments has latterly become.

A very large branch of mining industry in Ireland, that of iron pyrites or sulphur ore, becomes the basis of an extensive series of chemical manufactures, which, however, are limited, just as in the case of iron smelting, to those branches in which the cost of fuel does not form a preponderant proportion of the total cost of manufacture. In Dublin, Cork, and Belfast, large quantities of sulphuric acid, of chloride of lime, sulphate of soda, magnesia, &c., are made; the important branch of alcali making, as caustic and carbonate of soda, however, is not, as I believe, carried in Ireland beyond the manufactures of sulphate of soda.

In mentioning the absence in Ireland of deposits of bituminous coal of industrial importance, it is, perhaps, proper to mention that several extensive coal fields, yielding, however, principally anthracite coal, exist in the interior of that country, and are worked with success and profit. Their produce is, however, not so well fitted for manufacturing purposes, and is all employed for domestic purposes in their localities.

I cannot pass from the subject of Irish fuel without reference to what constitutes so important a feature in the scenery and the agriculture of Ireland, the Irish peat-bogs. The reclamation of those great tracts of land to the uses of agriculture, and the employment of those stores of peat to the purposes of fuel, have occupied, and very properly, a very large amount of attention; but, whilst recognising fully the importance of the subject, it will be seen that the progress of society and of the industrial arts in later years has divested the question of much of the paramount importance that formerly belonged to it. In regard to the restoration of the peat-bogs to agricultural purposes, the first and necessary element must be a perfect drainage, a measure of truly national importance, indispensable for the proper cultivation of even the best land, and, in considering which, the improvement of mere peat mosses cannot be held the primary object. But now that by the researches of Liebig, of Lawes, and others, the true principles of the growth of agricultural crops are understood; it is well known that even thoroughly drained peat will not supply the materials required for the production of food, and that the cost of supplying those materials, in the form of manures, if applied to the same area of land of more suitable constitution, will yield greater and more profitable returns. Hence, where ordinary farm land can be obtained,

its improvement is preferable, as a field for the employment of labour and of capital, to the reclamation of peat bogs.

Similarly, the altered circumstances of the country have deprived the question regarding peat as a fuel of much of the importance that formerly was attached to it. The facilities for internal intercourse afforded by the railway system which Ireland already possesses, and which tends every year to expand, together with the low rates of freight, which allows the introduction of sea-borne coal at moderate prices, all tend to limit the area within which peat as a fuel can be advantageously employed, and to confine its use to the vicinity of the bogs and to the agricultural population. The heating power of peat being, even when best prepared and driest, not more than two-thirds of that of coal, together with the greater cost of transport of a bulkier and less valuable article, place a limit to its economy which will determine practically the area within which it can be employed. The various plans proposed from time to time for the preparation of compressed peat have, therefore, been found not to possess the pecuniary advantages which had been at first expected from them, although eminently successful in so far as producing a compact, convenient, and agreeable fuel, which, in some respects, may deserve a preference over coal, although it cannot do so for general manufacturing purposes.

The soil and climate of Ireland has always been favourable to the growth of wool, especially of the longer stapled kind, and at an early period the quantities of Irish wool exported to England were considered to interfere so much with the interest of English wool growers as to lead to some harsh fiscal regulations. Owing to various circumstances of the country and of the times, the woollen trade of Ireland had declined very much indeed, until within the last few years, when it began to revive, and it is now every year rapidly expanding in extent of business and in the variety of articles made. Thus in Dublin, in Cork, in Waterford, and in various inland towns, woollen and worsted mills that had been abandoned have resumed work, mills already in action have augmented their number of looms and spindles, and new mills are being erected. This great improvement is partly due to the fact that the diminished supply of cotton has produced a general increase of activity in the woollen trade, and also to the excellent character which Irish-made woollen goods have acquired in the English markets, being practically free from those sophistications that are but too commonly in use. The actual expansion of this branch of industry within ten years is shown by the fact that the number of woollen and worsted mills in Ireland had increased from nine in 1851 to forty-three in 1863; being nearly 463 per cent.

The cotton manufacture exists in Ireland, but to a limited extent, and latterly, since the diminution of the supply of cotton, many mills have been altered from cotton to flax spinning and weaving, in order to meet the increased demand for linen goods. This has been the case to a great extent with the factories of Messrs. Pim, at Dublin, and of Messrs. Malcolmson, near Waterford. The latter, belonging to the same enterprising family which I have mentioned already in reference to the building of iron ships, is one of the most completely organised manufacturing establishments with which I am acquainted. It contains 31,000 spindles and 950 power-looms, with all the necessary machinery required for the spinning and weaving department. Being to a great extent isolated from other works they are obliged to depend on themselves, in many cases, for the construction and repairs of machinery, and hence there is attached to the mill a foundry and mechanics' shop, where machinery equal to any made in the best English workshops is constructed. The total number of hands employed by the Messrs. Malcolmson, in their various works, may be taken as averaging about 3,000.

The mixed woollen and silken tissues, which are known as poplins, or tabinets, have been considered as peculiarly an Irish fabric, but the manufacture was first introduced into that country at the beginning of the eighteenth century, by some Huguenot refugees. This branch of trade had of late years considerably declined, until the recent commercial treaty with France, which opened up the markets of that great country, where the rich tissues of the Irish looms were extremely popular. Since that time the poplin trade has been very active, every competent hand being fully employed until within the last three months, when a reaction appears to have occurred, which has somewhat diminished the demand. This interesting branch of trade gives employment, principally in Dublin, to more than 1,200 persons, of whom about one-fourth are employed by the Messrs Pim, a firm active in all that tends to promote intellectual cultivation and industrial habits, giving, in their various departments of business, occupation to over 1,000 hands, and providing not merely for the material wants of those in their employment, but practically evincing most praiseworthy interest in their moral and social life. By the example of such employers, labour is truly dignified, and leaders of industry vindicate their right to the high position which, in this country, has been so justly conceded to them.

Of all branches of industry, however, that which is of most importance to Ireland, from the amount of capital it represents, and the number of persons to whom it gives occupation, is the linen trade. I am indebted to the kindness of Mr. M'Ilwrath, secretary to the linen trade of Belfast, for much valuable information on that subject, and also to Mr. M'Call, of Lisburn, for many interesting particulars, of which I shall endeavour to lay before the Society such general heads as our limited time may allow.

The linen trade of which Belfast has been long the established head-quarters in Ireland had been rather falling off in amount, until the interruption of the supply of cotton by the American War called it into immensely increased activity. The contrast in this regard is well shown by the following figures:—In 1859 there were in Ireland 82 flax-spinning mills, containing 651,872 spindles, of which 91,230 were unemployed; whilst in 1864 there were 74 spinning mills with 650,744 spindles, of which but 8,860 were unemployed, whilst 50,638 additional spindles were in May last about being set to work. Further, in addition to the above there were employed in 1864, 14,648 spindles occupied in making thread, and five mills were in course of erection to contain 45,000 spindles. In regard to power-loom factories for linen, a similar remarkable increase is shown for the same period. Thus, in 1859, there were 28 factories with 3,633 looms, of which 509 were unemployed, whilst in 1864 there are 42 factories with 8,187 looms, of which but 258 are unemployed; 1,685 additional looms were about being set to work at the date of the return in May last. The introduction of the factory system into the linen trade, and especially the power-loom, is comparatively modern, the first spinning mills for flax in Ireland having been established about 1828, previously to which time cotton spinning was much more extensively carried on in Belfast than it has since been.

The great extension of trade and the benefit to the operative classes which followed this change, may be illustrated by the following fact:—When spinning and weaving were done by hand, the firm of Richardsons, of Lisburn, turned out from 15,000 to 20,00 pieces of goods in twelve months; that firm can now deliver 250,000 pieces of bleached goods in the same time.

As to wages, in the old days of spinning on the domestic wheel, the earnings were from 2s. 6d. to 4s. weekly, whilst at present in spinning mills the ordinary work-women make from 3s. 6d. to 6s. per week, and superior hands from 6s. to 8s. The best hand loom weaver can only make 6s. per week, out of which he has to pay charges which leave him only 5s., whereas an ex-

pert girl, who can attend to two power looms, can make 10s. per week clear. Thus the earnings of individuals have been materially increased by the introduction of steam machinery in the linen trade; and in regard to the total amount of employment, there were ten years ago, 17,000 persons employed in this trade in and about Belfast, whereas in the present year the number employed in the mills is 25,000, exclusive of the vast number of outsiders who indirectly derive their subsistance from that branch of manufacture.

Coupled with this developement of the linen trade there has taken place a great increase in the quantity of flax cultivation in Ireland. During the Crimean War, when the Baltic trade was subjected to certain impediments, the quantity of land under flax was increased and amounted in 1853 to 174,579 acres, but on the restoration of peace, the Baltic trade being resumed, the demand for home-grown flax diminished, and the cultivation fell off to 91,646 acres in 1858. Since that time it has again progressively increased, and has now assumed proportions entirely unprecedented, the quantity in 1863 having been 214,099 acres, and in the present year having increased to 301,942 acres, which at an average of 35 stones of clean scutched flax to the acre, gives the produce of fibre at 10,567,970 stones, or 66,050 tons: and at an average price of 7s. 6d. per stone, the total value of the crop of the present year, is £3,962,989. This great increase of production is accompanied of course with corresponding increase of the export trade. The total value of linens exported from the United Kingdom has nearly doubled within the last three years, having been in 1863 £8,469,036, against, £5,193,347 in 1861.

A corresponding increase has taken place in the branches of steam engine and machine making connected with the linen trade. The foundries and workshops occupied in that way have fairly doubled in extent of business and number of hands employed, while wages have increased within the last two years from 10 to 15 per cent. Simultaneously, the general trade of Belfast has increased to such a degree, that in the year 1863 the imports amounted to £8,505,991, and the exports to £10,472,598. The tonnage of the port in 1861 was 920,800 tons, and the revenue £40,600, whilst in 1800 the tonnage of Belfast had been but 54,200 tons, and the revenue collected but £2,740.

Closely connected with the linen and cotton manufactures are the important industries to which the refuse and worn-out remains of textile fabrics are devoted, the manufacture of paper and pasteboard. This branch of trade is extensively carried on in Ireland, especially in the neighbourhood of Dublin. The quantity of paper manufactured annually at the time the duty was repealed, was between 9 and 10 million pounds. The advantage afforded to the introduction of foreign-made paper by the late commercial tariff has depressed the condition of the paper trade in Ireland as it has done in this country, but it may be hoped that the relaxation of the export duty on rags, which has lately been made in the Treaty of Commerce between France and Switzerland, will mitigate, after some time, the disadvantage under which the British maker is now placed. In regard to specially Irish interests, I may mention that the lower price of straw in Ireland has led to a very extensive manufacture of the low-class paper containing that material, and that a large proportion of the cheap literature of London is printed on Irish manufactured paper.

A very large source of employment is afforded throughout Ireland, especially in the northern districts, in the sewed muslin trade, which occupies, it is estimated, over 300,000 females. The products of this industry are generally sent into commerce as Scotch, the greater number of the firms giving out the work being of that country. Indeed, this class of occupations are curiously cosmopolite, and illustrate the tendency of industry to overcome the distinctions of country and of race. Thus in the trade of shirt making, by which considerable employment is given in Ireland, I have been informed that for some large houses the shirts are cut out and sewn in Ireland, are then sent to Scotland to be washed, thence they pass on to London to be made up and prepared for sale. Most of the shirts, however, manufactured in that way are intended for exportation.

Minor industries of that class are, I am happy to say, being introduced and extending themselves in Ireland. Thus the making of ladies' corsets and crinolines was commenced in Dublin by the enterprise of Mr. Crotty, some few years back, and his firm now employ 700 girls, who earn from 5s. 6d. to 10s. per week, producing at the rate of about £60,000 worth of corsets per year, all of which, as I believe, are exported to this country. For it is a remarkable, and I believe a healthy characteristic of Irish manufactures, as they are now carried on, that they do not depend for their success on any excitement of misdirected though honest patriotism or protection. In fact, the prejudice is entirely the other way, and the Irish manufacturer meets much more ready customers abroad than he can find at home. This, however, is not peculiar to Ireland. Simiiar feelings are met with in every country; and it is most creditable to the manufacturers in Ireland, that in every branch their products find a welcome reception both in Great Britain and in foreign countries, grounded on the confidence which has been established in the honesty of the materials, and the excellence of their make.

It would be unsuitable, if, in speaking of Irish manufactures, I omitted noticing what had been long considered the staple manufactures of that country—porter and whisky. Of the latter, the production and consumption has of late years very much declined, the quantity of Irish made spirits entered for consumption having fallen off from 8,136,362 gallons in 1853 to 3,898,268 gallons in 1863. This enormous decrease is due partly to the increase of duty, but I believe in a greater degree to the improved habits of the people. A large increase in the production of ale and porter is shown by the returns of malt on which duty was paid, which rose from 1,376,148 bushels in 1855 to 2,234,947 bushels in 1863. This increase, however, is in great part represented by the development which the export trade in porter has received.

Those remarks will serve to illustrate in some degree the position which the Irish manufactures may be expected to take in the approaching Exhibition, and although, with the exception of the linen trade, not comparable in extent with the same branches of industry as carried on here, yet it will, I believe, be found that what is done is done well, and will establish their right to an honourable companionship with their fellow-labourers in Great Britain.

I am indebted to my friend Mr. Barrington, who, I hope, will have the honour, as Lord Mayor of Dublin in the coming year, to receive in a manner worthy of the city and of the great manufacturing firm which he so efficiently represents, some details as to the position of the soap and candle trade which is carried on to a considerable extent in Ireland, especially in Dublin; about 230 tons of hard soap and about 40,000 dozen pounds of candles being made weekly. This manufacture, which has been said to constitute a test for the civilization of a country, is steadily progressing in Ireland.

Under these circumstances, I trust that the manufacturers of Great Britain will not hesitate to lend their assistance towards rendering the Exhibition a sufficient representation of the productive power of our common country. Now that the intervening channel has been practically bridged by the splendid steamers which give to the passage more than the security and almost the comfort of the railway train, the journey from London to Dublin occupies but a portion of a day, we may by our uniting on the common ground of industrial fellowship, contribute to cement that union by which the greatness and the tranquillity of the empire is secured. The position and the prospects of Ireland have been represented

in very desponding colours. Her woes and losses have been eloquently traced to commercial jealousy and political misgovernment, and there has been but too much foundation for that charge. We have, as I hope, however, passed from the crimes and errors of an ignorant and bigoted age into a time when the blessings of education have taught all classes the true road to national prosperity, and when a more enlightened and tolerant spirit governs the relations as well of nations as of individuals. Scarcely beginning to recover from the fearful visitation of the potato famine, Ireland has had to pass during the last five years through a succession of wet seasons and bad harvests, entailing and annual loss estimated by the highest authority, Judge Longfield, at five millions annually, or 25 millions in the 5 years. No wonder then that her agricultural capital has not augmented during that time; that the quantity of live stock has not been multiplied; that the area under cereal crops has not increased. But, with all this, even with the emigration of a class which it would be desirable if possible to keep at home, the amount of crime has been diminished by one half, and of pauperism to six-tenths within the last ten years, whilst wages have risen as well in agricultural as manufacturing districts to a point practically equal to the cost of labour in this country.

Our visitors next year need not imagine that in crossing a narrow channel of the sea they will pass into a wilderness, where agriculture is abandoned and trade extinct, among a population, lawless and pauperized, abject and ignorant, whose only signs of national activity are outbursts of political and sectarian strife, miserably caricaturing that grand struggle which settled the constitution of this country a century and a half ago. Under a surface scum of passion and discontent, which represents the former Ireland, and is every day melting away, the humanising influences of education, and of equal laws, have called forth a new and a better Ireland, a population intelligent and moral, peaceful and provident, able and willing for any work that may be set before them, and seeking such work even in the most distant portions of the globe. Such a people require only fair and considerate guidance and example to constitute themselves admirable materials for industrial enterprise, and prove themselves worthy to participate in the prosperity and power of this great empire. I regard, as highly conducive to that great end, that our British neighbours, especially those who are themselves engaged in industrial pursuits, should know more of Ireland and of its people; that they should learn to judge of the people and of the country as they now are, and not by the newspaper exaggerations, or stories of a by-gone time. Such means of calm and dispassionate judgment will be afforded by the opportunity of the Exhibition next year; and—as I believe the result will be to elevate the position of Ireland and of its people in the opinion of those who are most competent to decide, as well as most interested in the result—I do trust and expect that England and Scotland, as well as more distant foreign countries, will be well represented as visitors and as co-operators in the approaching Exhibition.

DISCUSSION.

Lord Powerscourt, in responding to the call of the chairman, would as Chairman of the Fine Art Department of the Exhibition, offer a few remarks. There could be no doubt that the Fine Arts could not flourish in a country which was not materially prosperous. Refinement and art were the children of education, and education in any country was not obtained without a certain degree of affluence. The history of the world showed that the wealthiest and most powerful people had been the foremost in the fine arts. The great emporiums of riches and commerce, such as Manchester, Liverpool, and other manufacturing cities, were the places where at the present time the greatest encouragement was shown to painters and sculptors. Ireland, unfortunately, was not in the position of affluence and superfluity which England enjoyed. The causes of this state of things he need not enter into, but in a backward country like Ireland the difficulties were great, on account of many conflicting and antagonistic interests. It was, however, more than ever the object of any lover of his country to do what he could to promote the civilisation and refinement of his countrymen; and in cultivating a taste for the fine arts, he believed we should aid materially in this direction. Unfortunately his countrymen had not yet sufficient confidence in a rule which sought to place them as free citizens on a noble equality with the rest of civilization by means of education and refinement. He thought if all classes in Ireland gave more encouragement to the arts and sciences, it would tend to raise Ireland to the level of other countries. International Exhibitions were great promoters of intercourse, and friendly intercourse promoted mutual improvement. He was happy to add that the prospects of the Exhibition in that department over which he presided were most encouraging, and he had no doubt that the artistic display in Dublin, in 1865, would be of a very attractive character.

Mr. Vesy Fitzgerald said, more than anything else with which he was acquainted, these Industrial Exhibitions demonstrated the fact that individual effort, in the present age, attained the largest results when it availed itself of the power inherent in the principle of co-operation; for these exhibitions depended on the co-operation of class with class, of country with country, and of man with man. They produced fruit, and the production of fruit was what Lord Bacon held forth as the great recommendation of his system of Inductive Philosophy, which had formed the basis of the development of science and of material progress that had been witnessed by the last two centuries. All the education of the popular taste and faculties which was imparted by the study of the Fine Arts, was afforded in the most effective manner by these exhibitions. But they led also to an advance in artistic skill, and to the general improvement of manufacturing processes. The Committees appointed by this Society, in consequence of the last Great Exhibition in London, were calculated to be of great use in this way, and, without doubt, would prove to have been most useful, but it was, of course, difficult to know the exact nature of improved processes adopted by individual producers, until all idea of secrecy connected with them had passed away; so that it could not be immediately ascertained. New articles, and patterns of various goods, however, met one's eyes every day, the idea of which was taken from things seen in those Exhibitions. He would conclude by expressing his conviction that the principle of improvement inherent in these exhibitions was most powerful in its operation, and that the extent to which it might probably be felt was obviously impossible to estimate.

Mr. Hercules Macdonnell, in responding to the call of the Chairman said, it was not his intention to enter into any of the many general topics which had been so well discussed in the interesting paper they had heard. He merely wished to add, as supplementary to what they had heard from Sir Robert Kane, a few facts which had come within his own personal knowledge, and tending to show that the exhibition was likely to be eminently an international one. As one of the Executive Committee, it fell to his lot to put himself in communication with foreign governments, and more particularly those of Southern Europe. He begged, in the first instance, to return his thanks to the members of this Society and to the officers of the South Kensington Museum, who had furnished him with information as to the best means of proceeding, and with introductions to those most likely to aid him in his object. They had supplied the much-needed compass without which he would have been unable to steer his course in this, to him, novel undertaking. He in the first instance went to France, and he was happy to say his application was not at once acceded to. The French

Minister showed great willingness to listen to all he had to say, but he required to be satisfied as to the soundness of the undertaking. The result was, that the Government was satisfied on that head, and decided that the enterprise was deserving of their support and co-operation. And here he might say the promoters of this exhibition did not feel themselves in the position of those who undertook a similar duty in 1862—viz., to solicit foreign governments to give pecuniary aid to the undertaking. It was felt by the promoters of the undertaking that all they could ask foreign governments to do was to forward the goods of their exhibitors to the nearest seaports, from whence the managers of the Exhibition would provide for their transport to Ireland, undertaking to send back the objects unsold to those ports, and to pay the insurance. In France he was happy to find that so able and enlightened a government gave its assistance and co-operation to the enterprise, Prince Napoleon, who was not only a prince, but a man of great talent and large experience in exhibitions, took up the matter warmly, and he (Mr. Macdonnell) had reason to think the opening of the exhibition would be honoured by his presence. Backed by the example of so great a nation, he next proceeded to Belgium, where, he was happy to say, he met with ready and almost enthusiastic co-operation, and many of those who acted as commissioners for the Exhibition of 1862 had undertaken the same duty in regard to the forthcoming Exhibition in Dublin. From thence he proceeded to Holland, where he met a very warm response, and that country would be well represented, and no doubt would acquit herself well in this contest of nations. After that he went to Frankfort, which, though not great in itself, was a most important commercial centre, and there a commission of men of the highest standing was formed, by whom would be brought together the varied products of the various States of Germany. He afterwards proceeded to Switzerland, and he had reason to believe that there would be a good representation of the special products of that country, and they were not few. Thence he went on to the Kingdom of Italy—now more important than ever—and there he found the government most willing and anxious to do what they could towards this enterprise, though they could not undertake a money expenditure for the purpose. He (Mr. Macdonnell) stated that pecuniary assistance was not asked for; all they wanted was the official patronage and encouragement announcing to their subjects that the enterprise was deserving of support and co-operation. He was happy to state a large committee had been formed in Turin, comprising the first men in Italy; and the question now was, not whether they should get objects from Italy, but where they should put them. Milan would send some of her best sculpture, and Florence would not be behind in artistic productions. In Rome, too, after some preliminary difficulties, he received the assurance of Cardinal Antonelli, and from the Pontiff himself, that it should not be their fault if Rome was not as well represented in Dublin in 1865 as she was in London in 1862; and he had since his return received a despatch, stating that a commission of the leading men of the country had been appointed to take charge of this matter. Austria was the next country he visited, and there the difficulties on financial grounds were as great as in any other quarter, which, however, he could not quite so readily meet, because he could not undertake to send a steamer to Vienna; but in this respect the ready assistance of the Rothschilds was accorded in getting a reduced tariff on the railways for conveying articles to the seaboard, and he had every reason to expect an excellent collection from Austria. From Bavaria and Munich, the great centre of mural decorations, there was a probability of some of those cartoons being sent which had not appeared in any previous exhibition. He believed every country in Southern Europe would be represented in its art and manufacturing productions. With regard to the usefulness and importance of such a display there could be no doubt. Sir Robert Kane was quite right in saying there was no antagonistic rivalry between the progress or the genius of England and Ireland. On the contrary, he thought the one supplemented the other. The paper of this evening, as well as the discussion on it, would, he trusted, assist an enterprise whose only object was the advancement of their common country.

Mr. Antonio Brady said he had been deputed to visit the north of Europe. He had taken the Scandinavian nations, and he had also good results to report. He had, however, met with the same objections on financial considerations as had already been referred to. The Swedish Minister had especially referred to the excessive expenditure incurred in the last Paris and London Exhibitions, which he was not prepared to recommend again. He was also met in many places with the idea that Ireland was a sort of Poland, in a state of anarchy and revolution, and there was no security for articles exhibited; and he was glad to find that Sir Robert Kane had given a very different and more truthful view of the general condition of the country. He desired to express his deep obligations to the officers of the South Kensington Museum, and especially to Mr. Owen, who had rendered the greatest service, not only by his advice, but by his letters of introduction to the leading foreigners who had been connected with the Exhibition of 1862. Having duly acknowledged the ready co-operation and courteous attention afforded by our ambassadors and consuls, Mr. Brady stated, that the encouragement he met with throughout the Scandinavian provinces was such as to enable him to assure those interested that most valuable contributions of artistic and manufacturing productions would be forthcoming from those northern nations. As regarded Denmark, unhappily he arrived just as that unhappy war, which had crippled the resources of that country, had closed. The enlightened government of that country, from the king downwards, had, after due consideration, promised hearty co-operation. The king, himself no mean artist, had promised to contribute to the Exhibition, and he (Mr. Brady) was confident in the belief that Denmark would be as well represented as any other country in Europe.

Mr. Chichester Fortescue, M.P., having been called upon by the Chairman, said, as a member of the Colonial Department of the Government, he was glad to have the opportunity of saying, not only on his own but on the part of his right hon. friend at the head of that Department, it had given them great pleasure to have been the means of bringing this laudable enterprise before the notice of the colonies of Great Britain. He was not prepared to state in detail what the colonies respectively were prepared to do, but in general terms he might safely state that they were ready to respond to this invitation, and that the colonies of Great Britain would be properly represented in the capital of Ireland, as they had been in the capital of England. But, as an Irish member, he could not refrain from expressing his thanks to Sir Robert Kane for the extremely valuable and interesting address he had that evening delivered; and, more than that, he would express his thanks in the same capacity, if they would allow him to do so, to this assembly for having met here for the purpose of listening to and discussing such a subject as this. He thought it must strike many of them, as it struck him, while listening to Sir Robert Kane, how very great the contrast was between the former days to which he alluded and the present. He talked of days when Irish wool imported into England was considered a nuisance, but, among all the statements and evidence put before them by Sir Robert Kane, there was none to which he attached more value, or for which he was more grateful as an Irishman, than the hopeful spirit he had expressed in his address. He felt inclined to thank every Irishman —above all every distinguished Irishman—who, like the ancient Roman, did not despair of his country. He confessed they heard too much, both from the press of Ireland

and from public men, of that kind of despair which was too apt to fulfil its own predictions. He confessed a good deal of blame on that score attached to the class of men to which his noble friend and himself might be said to belong—viz., to politicians. He did not use it as a term of reproach, though across the Atlantic "politician" was about the worst name one could call a man; but, happily, that was not yet the case on this side of the water. No doubt the last three or four years had been years of great trial to Ireland; but it was consoling, when unhappy, to know the cause of the unhappiness, and if they were suffering from misfortune to know its source, and look forward to its termination. He believed there would not be a doubt that Sir Robert Kane had told the simple truth. He had heard from Irish farmers and men of business that the temporary check which had been experienced—for it was nothing more than that—had only been caused by the exceptional disadvantages of the three last summers. It was a misfortune to a country to have but one string to its bow; and one of the great objects of this Exhibition was to endeavour to provide Ireland with other strings to her bow. He trusted what they had heard to-night would induce many in this room and out of it, and those of other countries, to visit Ireland for themselves, to see what she had done, and what she could do; and he hoped foreigners would see that the miserable and contemptible libels poured on Ireland from some quarters were odious falsehoods. They would find that Ireland was not another Poland, but, on the contrary, a country—no doubt with many things, like other countries, requiring correction—but a country well governed, and capable, by exerting self-reliance, of taking a creditable position by the side of this country as an integral part of it. He trusted that would be the effect of this great enterprise. He trusted large numbers would visit the Exhibition and would make that passage between England and Ireland which Sir Robert Kane had described in such glowing terms.

Mr. Henry Cole, C.B., would merely call attention to one point which had not been touched on, either in the paper or in the remarks that had followed it. He hoped the Managing Committee of the Exhibition would provide for that which was now attracting great attention in London, and which might be made an interesting feature of the Exhibition in Dublin, viz., an exhibition of the industry of the workmen of Ireland, as a separate section. Of course the works of artisans and others would be exhibited among the manufactures, but he thought an attractive section might be made if the workmen of Ireland were inclined to show the fruits of their ingenuity.

Dr. Bachhoffner was anxious to know whether it was the intention of the Commissioners of the Dublin Exhibition to apply to the Government to pass a short Act of Parliament, as was done in the case of the Exhibition of 1862, for the protection of unpatented inventions.

Mr. Macdonnell stated that the Attorney-General for Ireland would prepare such a Bill to be introduced on the assembly of Parliament.

Mr. W. Hawes remarked that hitherto the discussion of this able paper had assumed almost entirely an Irish character. As he thought the facts stated and the views taken by Sir R. Kane were equally important to them as Englishmen—equally important to the whole country as to Ireland alone—he hoped he might for a few moments call attention to the facts, to show how they as Englishmen were interested in the success of this exhibition. They could not see the progress of manufactures, of industry, and education; they could not hear that wages had been increased, that vice had diminished, and that the consumption of spirits had enormously decreased, without feeling that a country which perhaps had not hitherto raised the national character of the empire, was now progressing in a way which was calculated to make Ireland a source of great power and strength, and a country of which England had reason to be proud. As Englishmen we could contribute to the success of this enterprise, which had been so energetically taken up by the Irish people themselves. That Exhibition must not be received as a mere temporary display. It would have a permanent and beneficial influence on the industry and commerce of Ireland. It would stimulate her to rely more on herself, to establish new manufactures, and make herself more independent; and force into activity and life those seeds of prosperity which had long been lying dormant. A competition would be produced which would urge on both countries to produce better articles than they had hitherto done, and thus would the closer connection with Ireland and her manufactures result in benefits to both countries.

Mr. Hartley expressed his opinion that much of the evil of the industrial system in Ireland would be remedied by a proper system of apprentice laws, by which the extension of skilled labour would be promoted, and a great want of the country supplied.

The Chairman said it was his pleasing duty to move that the thanks of this meeting be tendered to Sir Robert Kane for the admirable paper which he had been kind enough to read to them; and he only wished, that in doing so, he could adequately express what he was sure was the feeling of every one who had heard him. At all events, if he was not able to find words which would satisfy those whom he had the honour of representing, he could assure Sir Robert Kane there was not one in the room who more thoroughly appreciated the perspicuity, the moderation, and the truth of every single opinion and every single fact to which he had given utterance. He might be permitted to refer to one or two points in which he could especially confirm, from his own personal experience, the observations made by Sir Robert Kane. Sir R. Kane had stated it was to the development of Irish manufactures that they must principally look for the prosperity of that country. In that opinion he cordially coincided. As an Irish landowner, he had been painfully aware of the innumerable ills which had arisen as a consequence of the undue pressure upon the land of Ireland. In consequence of so very few openings, indeed, he might almost say, no other opening being afforded to the industry of the country, except that which was connected with the cultivation of the soil, the peasantry of the country had been reduced to a condition which was incompatible with their prosperity or their comfort. There was no Irish landowner who, if he was a conscientious man, could dare to accept for his land the competition prices which would be offered for it. Land was, in fact, almost a monopoly, and the consequence was, the margin of profit to the cultivator, which in other countries was amply sufficient for education, decent clothing, and comfortable housing, was in Ireland reduced to the smallest possible extent. He was happy to be able to confirm, from his own experience, what Sir Robert Kane had stated with regard to the enormous stimulus which had been of late given to the linen manufacture. He happened to live in the neighbourhood of Belfast, and he believed nearly every manufacturer in that town was making something like £1,000 per week at this moment. A personal friend of his own, who, having acquired an ample fortune, was about to retire from business, offered his mill for sale two years ago, at the price of £80,000, and was bid only £70,000 for it, consequently he retained it in his possession, and a few months ago he had the satisfaction of disposing of it for £180,000. Before he concluded, he thought he should be fulfilling the wishes of those present if he expressed their thanks to those two gentlemen who had acted as ambassadors to other countries on behalf of this Exhibition. He would now, on the part of the Society, return to Sir Robert Kane their most hearty and cordial thanks for the services he had rendered to them and to the cause of the proposed Exhibition, and of Irish manufactures. When, hereafter,

Ireland should have attained that position of eminence in that career of progress which he trusted was now opening before her, the name of Sir Robert Kane would be remembered in the catalogue of those men whose patriotism and devotion to their country had laid the foundations of her prosperity.

Sir Robert Kane expressed himself as much gratified by the kind manner in which his paper had been received, and also by the way in which the Chairman had been pleased to express the thanks of the Society on this occasion. He assured the noble lord and the Society there was nothing from which he expected more practical advantage to the cause of the prosperity of Ireland than the increase of mutual good feeling and co-operation between this country and his own.

BRITISH ASSOCIATION, BATH, 1864.

On the Practical Progress of Naval Architecture in Ocean and River Steamers, Tugs, and Tow Vessels.

In the Mechanical Section, Capt. Andrew Henderson, C.N.E., A.I.C.E., read a paper on this subject, in which he entered upon the various types, from the Leviathan to the Nautilus, and systems of steering and towing, as shown in the summary of results of trials and performances in England and India, and illustrated the subject by diagrams, plans, and models, with tabular record of their relative dimensions, cargo, draft, displacement, and other elements of resistance, engine-power, and speed realised, and measured by dynamometer, the *plus*, *minus*, and *frictional* resistances of three types of vessels at three different speeds, giving their relative drafts and capability for cargo: with suggestions for improvements in the steerage of the *Great Eastern*, and large iron-clads of the Leviathan type, and small iron-clads, rams, and gun-boats, similar to the *Assam Nautilus*, by the use of balanced rudders in bow and stern. The reading of the paper was prefaced by a reference to the models of the four types of river steamers and barges, the resistance of which had been ascertained by dynamometer at trials in this country in the Nautilus, or native type, the Assam type, as established on the Burhampooter, and the Punt type, or Bourne's Patent Train of Articulated Barges, tried on the Thames, Tyne, and Clyde, in 1859-60. The model of the dynamometer showed the mode of application to the tow rope, and a printed return of test trials was furnished of those as well as of the large Indus troop steamer, tried on the Thames in 1861, representing the European type of river steamers on the plans of a Government commission.

The sheer and deck plans of the European type, the Punt type, tried on the Indus, and of the Assam type and Nautilus, or native type, were shown in a comparative plan of midsections of ocean steamers and clipper ships, published with the paper read before the British Association, at Liverpool, in 1854, with suggestions for the improvement in the steering of the *Great Eastern*, *Warrior*, and other iron-clads. The author said, in explaining a subject so complicated, it was difficult to give in a small compass the results of experience of many years. In the early establishment of steam communication in India he took a leading part, and subsequently devoted his time and attention to improvement in the form and construction of river steamers, and making experiments in steering and towing with a view to economic transit. His nautical experience originated in service in her Majesty's ship *Bellerophon*, and her boats, and in merchant shipping in voyages to India and the Pacific, the coasts, ports, and rivers in India, China, and the Eastern Archipelago, the latter in a very fast-sailing old American privateer, and subsequently superintending the building and fitting up of the Forbes steamer, of 300 tons, and 120 H. P., as a tug on the Hooghley, and opening steam communication between India and China by towing the *Jemesina*, of 380 tons, from Bengal to China against the Monsoon, in 1830. In 1831 he built the clipper *Water Witch*, 380 tons, in Calcutta (a model of which was shown) partly on a French model, designing himself the masts, sculls, rig, and fittings. After twelve successful voyages to China, she was dismasted, on the last, owing to the strain on the wing transom jamming the rudder. Based on this experience he designed the *Ariel*, with fuller after lines and round stern.

On his return to England in 1837, at the request of the late Lord William Bentinck, he gave evidence before Parliament as to steam communication in India, and after obtaining information from that eminent draughtsman, the late Mr. Waterman, he participated in the formation, in London, of the East Indian Steam Navigation Company and Assam Company, in 1839, the former proposing to the Indian Government to carry a monthly mail to the three presidencies of India in vessels of 2,000 tons, for a guarantee of £100,000 a year. The Assam Company was formed in 1839, by the union of Local and London Company to take over the Government tea gardens in Assam; and as a director of the Local Board, he designed and contracted for a steamer, barge, and portable saw mill, specially adapted for the service of the company, and as a Calcutta director, in 1841, tried and established the steamers on the Bengal river.

A model of the steamer, with bow and stern rudders, was shown on the table, the origin of the Assam type and balanced rudder system of steering. Between the *Water Witch* and *Assam* models are those of a first-class flotilla of the Assam type, tug and two auxiliary tow vessels, 35, 33, and 30 ft. broad, and 200 feet long, to carry 1,200 tons, 10 miles an hour, with 250 horse power. The *Sir James Melvill*, 33 feet broad, 130 horse power, was sailed out with false bottom, as shown by the model and plan, and is now towing two barges similar to the trial barge, 30 feet broad, and has been profitably employed on the Ganges and Burhampooter since 1863, by the River Steam Company of Calcutta.

Three steamers, 35 feet broad and 170 horse power, similar to the trial barge of the Assam type, and his models, are now on the Bengal rivers, which he considered as the practical progress towards improvement in his large class flotillas, as, exemplified by the drawing appended, shown on one-sixteenth inch scale, sheer and deck plan of tug and two tow barges, of the above breadth, illustrating the system of steering and towing with balanced bow and stern rudders and radial tow spar; and on ¼ inch scale the details and improvements in fitting balanced bow and stern rudders, resulting from the numerous trials in the experimental *Assam Nautilus*.

Proceedings of Institutions.

Manchester Mechanics' Institution.—On Friday evening, Dec. 2, a meeting was held in the Mechanics' Institution, Mr. O. Heywood in the chair, for the distribution to the pupils in the Institution school and classes of the prizes and certificates won by them in the last examinations. The Chairman said the Institution had about 1,300 members, of whom about 300 were life and honorary members. The classes of the Institution were better and more regularly attended, and more real industrious work done and more steadily done now than for a long period. The number of teachers in the day and evening classes was twenty-five, and to them the Institution was largely indebted for its present distinguished position. The number of general members of the Institution was, however, less than it was five or six years ago. Notwithstanding that the classes were better filled, and that more honours were obtained, the Institution did not retain its old members. The Directors had made efforts to overcome that disadvantage by establishing a billiard-room and a gymnastic class; but the fact remained the same,—they kept no hold on those who had got beyond the practical teaching

of the classes. That should not be. He hoped that, as they had done before, so again the Directors would succeed in striking out new lines and courses, so as to make the Institution as attractive and amusing as in other respects it was instructive. In 1858, the first year that the certificates of the Society of Arts were awarded, 19 certificates, in all, were taken by the students of the Mechanics' Institution. In 1859, the Institution took three first-class certificates; in 1860, two; in 1861, five; in 1864, 19 first-class; while 64 certificates in all were taken, and £8 in prizes. In 1863, the number of first-class certificates was seven; and of second class, fifteen. This year the first-class, as already stated, numbered 19; and second-class, 23. The number of third-class certificates was the same in each year, namely, 22. The increase this year was, therefore, mainly in the first-class. With regard to the Government Science Examinations, the Institution had in three years increased its first-class honours 2½-fold; in second-class honours fourfold, and in third-class honours twofold. Since last year the increase had been wholly in the first and second classes. The Institution this year took three silver medals and four bronze medals.—Lord Stanley, M.P., congratulated the members upon the flourishing condition of the Institution, which had preserved itself and its character through the vicissitudes of forty years, while many kindred Institutions had either perished or been converted into club-rooms for the middle classes, or centres for party organization. The work of a Mechanics' Institution is to continue for such persons as desire it, and to extend the very limited and imperfect teaching which alone a school for the industrial class, or indeed for any class, can pretend to give. His Lordship continued:—A boy is taught in his school, well or badly, as the case may be, till he is twelve years old. If his parents are poor, he does not stop much longer; and for myself I value so highly the advantages for an early introduction to the practical duties of life, that I don't grudge that early departure. But if he leaves at that age, he can have got very little beyond the mere ground-work of knowledge, the power of reading, writing, and cyphering; and, for my part, I wish schoolmasters would recognise that fact more clearly than they do. I don't think they quite understand of how very little use it is stuffing children's memories with facts, or with what are supposed to be facts, to which no definite idea is attached. I have heard boys rattle over names of kings and countries when I was quite sure not one in fifty of them had any definite notion of what was meant by a king, or what the capital of a country was. I have always said, and always shall say, that if a child learns at school to read easily, and with pleasure to itself, to write well, and by that I mean distinctly, and to do common sums, the schoolmaster has done his share, and other agencies will complete what he has begun. People are beginning to find out what, if they would use their own observation more, and not follow one another like sheep, they would have found out long ago, that it is doing positive harm to a young child, mental and bodily harm, to keep it learning, or pretending to learn, the greater part of the day. Nature says to a child, "Run about;" the schoolmaster says, "Sit still;" and as the schoolmaster can punish on the spot, and nature can only punish long afterwards, he is obeyed, and health and brain suffer. I have nothing to say against hard work—brain work or hand work; I believe it to be healthy, and that at a riper age those whom it injures are infinitely few compared with those whom it benefits. But you must let nature have her way. Three or four hours of attention are quite enough in a day for any child, and if you accept that principle it follows necessarily that the school must leave much undone, and that some other machinery of teaching is required, such as that provided here. It is the idlest folly to try to turn out men and women as you turn out manufactured articles, all done by one pattern. It takes some of all sorts to make up society. How often, in the upper ranks of life, one hears it said "So-and-so is a fine lad; he'll make a capital soldier, a sailor, or a colonist, but he has no turn for books." Do not mistake me. I think that the studious type of character is, on the whole, both the happiest and the highest. Men of that turn have pleasures and resources which others have not, and which never wholly fail. That is no small matter, because sheer weariness, dulness, the monotony of a life which is safe but not eventful, lead to half the mischief which men do to themselves and their families by falling into bad ways. All I say is (because we gain nothing by exaggeration), that those who take that line, those who care really for reading, and for self-improvement, will never, in any class, be more than a fraction of the whole. But then they are a very important fraction, important in the influence which they exercise, if not in their numbers. What we have to do, is to see that men of that type, in the less wealthy class, have a fair chance of developing such faculties as they may possess. Our business is to find the tools; let those who can and will use them; and that there will be, that there are many such, I do not doubt. The people of Manchester know what they are about too well to go on year after year spending money on a thing which gives them no practical return. It is often said, "Look at the very ablest and cleverest of your self-raised men, men that have had little or no instruction; very often they know next to nothing outside their own particular business." That may be true enough. Mechanical genius, or a turn for commercial enterprise, like any other gift, is born in a man. That is to say, we do not know how or whence it comes; but we do know this, that those who have the most of it, those who owed their success entirely to themselves, are the very men who are keenest in the desire that those who come after them should have better opportunities than they had. Look at George Stephenson! No man probably better understood the ideas or the wants of the class from which he sprung; and no man more warmly interested himself in institutions of this kind, as the people of the northern districts well know. His son, Robert Stephenson, was a man of the same stamp; and in that, as in other matters, he followed in his father's footsteps, and I think I am not wrong in saying, unless my memory fails me, that by his will he largely and liberally endowed an institution of this kind in his native town. On that point I should like to call some other eminent witnesses to the truth of what I am saying. Such witnesses would not be wanting, for the name of your late respected president—the name of Fairbairn—will, I believe, be remembered along with that of the two Stephensons. But he is happily present, and I shall allow him to speak for himself. I think that support which such men give to the work we have in hand, is a far stronger argument in its favour than if it were left to the interested assistance of parties or sects, to the patronage of politicians canvassing for popularity, or even to the not illiberal ostentation of millionaires desiring credit for the use they make of their wealth. There is one point in connection with this undertaking which it is always well to notice, I mean your independence of all state aid and of all state control. I fear that in other besides educational matters there is some decrease in that wholesome jealousy, with which the middle classes of England have always been in the habit of looking on any attempt of the executive to extend its functions. I say nothing against the help given to primary instruction, or, in plain English, to boys' and girls' schools. I believe that is necessary. The last generation had, and the present generation still has, to make up long arrears created by centuries of neglect. In such a case, private means would be utterly inadequate; and seeing a great work before it which must be done, and seeing only one means of doing it, the community had practically no option. But I hold that where the necessity ends, there the interference should end also. Freedom, security, industry, will always create large fortunes. Public opinion demands of the owners of wealth that they shall use it

liberally for the general good; and many a man (most men), if I may trust my own experience, would rather give £50 freely, with that reward which they naturally expect from the gratitude of their fellow-citizens, than have £5 screwed out of them by taxes. I don't object to these Government prizes, insignificant as they are in pecuniary value, though I believe if they were done away you would have as much or more contributed by private agency. But I should be sorry to see a system of grants and subsidies applied to adult education, however plausibly such a system might be defended. Even as regards optional inspection, which some people propose (though I don't say there is much harm in it), what can it do for you more than is done already by these various examinations—those of the Society of Arts, and those set on foot by the universities, both new undertakings, and neither costing a shilling to the public? State help has done nothing for English manufactures; English farmers are not trained in Government schools; nor have our great engineers come out of Government workshops. Yet our manufactures travel to every corner of the earth, our engineers are employed in every country, and our farming, imperfect though it may be, is probably the highest in Europe. The work on which you are engaged is only a part, it may be but a small part, of a great national movement. The school, the institute, the cheap newspaper, the cheap book, go together with the benefit society, the savings bank, the freehold cottage, the co-operative mill, and, better still, the co-operative store. —Mr. W. Fairbairn moved a vote of thanks to Lord Stanley, which was seconded by Mr. J. A. Turner, M.P., and carried unanimously, and the meeting separated after passing a vote of thanks to the Chairman.

Fine Arts.

Delacroix and Flandrin.—The exhibition of the collected works of Eugène Delacroix is about to close shortly. It is now proposed to gather together as many as possible of the paintings and sketches of the late Hippolyte Flandrin, and to exhibit them in the rooms of the *Ecole des Beaux-Arts*. Should this intention be carried out, and there is no reason to suppose that it will not, there is no doubt that a highly interesting collection will be the result, though the best, or some of the best productions of Flandrin's pencil must still be sought in the churches and other public buildings of Paris and other towns; nevertheless, the sketches for those large and elaborate works are, in an artistic point of view, deeply interesting. In the case of the Delacroix sale, this class of works formed by far the most attractive of the whole collection, and the same must be the case, or nearly so, in the instance of Flandrin. The Municipal Council of Paris has, on the proposition of the Prefect, followed the example of the Emperor, and voted the sum of a thousand francs in aid of the funds for the monument of Flandrin, to be placed in the old church of Saint-Germain-des-Prés, which contains so much of his painting. A commemorative tablet, in bronze, has just been placed on the façade of the house in the Place Furstemberg, in Paris, in which Eugène Delacroix died; another is to be affixed to the house at Charenton-Saint Maurice, where he was born.

Public Statues.—An equestrian statue of Napoleon I. is about to be raised in the Place d'Armes at Grenoble, to commemorate his passage through that town on his return from Elba. The Emperor is to be represented in the costume which he wore at that period. On the two long sides of the pedestal are to be placed bas-reliefs in bronze; one representing the Emperor at Laffrey, at the moment when, accompanied by a weak escort, and opposed by a troop sent to bar his passage, he is said to have bared his breast and to have cried—"Soldiers, I am your Emperor! Do you not know me? If anyone desires the life of his general let him take it!" The other bas-relief represents the Emperor outside Grenoble, at the moment when preparations were being made to force the old gate of Rome. The statue is to be in bronze, and placed on a bold pedestal of the fine stone of the Ardèche. Between twenty-five and thirty designs have been sent in for the monument to be erected to the memory of the late Minister Billault, in the town of Nantes; they are to be exhibited this week in the museum there.

Picture by Grenze.—A dealer in curiosities purchased a picture the other day of a country curé, near Cambrai, for fifteen pence, and sold it almost immediately afterwards for two pounds; after passing through one or more pairs of hands it was purchased eagerly by a rich amateur of Rheims for the sum of 3,100 frs. (£124).

Exhibition of Fine Arts at Bordeaux.—The exposition of the *Société des Amis des Arts* is announced to open in March next. Works intended for exhibition, including paintings, sculpture, architecture, engravings, drawings, and lithography, are to be sent in between the 1st and 10th of February. The society pays all expenses in case of artists invited to contribute, but the size of cases is confined to six feet in height and width; and the weight of sculpture to 400lbs. The present year is the thirteenth of the society's existence, and the exhibition was opened on the 20th of March and closed on the 22nd May. It contained 473 works of art, of which 113 were sold for the aggregate sum of 51,869 frs. The sales of the twelve former years amounted to 539,972 frs. (£21,599). Of these, fifteen works were acquired for the Bordeaux Museum, at a cost of £3,000. This year the Emperor became patron of the society, and contributed a thousand francs to its funds. The Conseil-Général of the Department voted 1,500 frs. and the Municipal Council of Bordeaux 1,000 frs., besides supplying the gallery for the exhibition without charge. The society counts 600 members, who subscribe each a pound a year.

Sales of Objects of Vertu in Paris.—The collection of the late M. Fossé d'Arcosse was disposed of the other day, and some of the objects realised very large prices. Amongst the most curious was an hour-glass which belonged to Henry II. The frame was supported by five columns in gold and mother-o'-pearl, at each end was a medallion in mother-o'-pearl, one representing the bust of the king, with the letters HR. FR., and the other the arms of France. The hour-glass was enclosed in a case of stamped leather, decorated with gold fleurs-de-lis, and was accompanied by two letters in proof of its authenticity. The whole fetched 2,000 frs. A small lantern, in paper and mother-o'-pearl, ornamented with silver, formerly the property of Marie Antoinette, sold for 89frs. A hammer, which belonged to Louis XVI., an elegant tool, ornamented with incised work, including dolphins and the letter L interlaced, fetched 130 frs. A small gun made for another unfortunate dauphin, Louis XVII., sold for 180 frs. A mother-o'-pearl medallion, bearing a bust of Louis XV., signed Durand, and presented to the king after the battle of Fontenoy, 120 frs. A snuff grater, formerly belonging to the regent, in ivory, ornamented with a subject from the story of Mars and Venus, and bearing the arms of the House of Orleans, 118 frs. A hunting knife, the blade pierced and engraved, and the handle in ivory, decorated with the arms of France and Burgundy, 232 frs. A miniature of the Princess Pauline Borghèse, by Isabey, 163 frs.

Charles V. Inkstand.—A very curious object is now on sale at a shop in Madrid, an inkstand, composed of Egyptian amber, ivory, gold, and carnelion, formerly belonging to Charles V. It is in the form of a Greek temple, of the composite order, decorated in all parts with carving and painting of high finish. In the interior are the arms of the Emperor, surrounded by portraits of all the members of his family. On the sides are figures of an immense number of the grandees of Spain of that period, cardinals, bishops, captains, generals, and beautiful

women. The lid is ornamented with a portait of Cardinal Ximénés, by the side of which are statues of Diana and Flora. The interior is divided into two compartments; in one is a statuette of the Emperor, and in the other that of the Empress; and at the foot of these are smaller figures, representing Piety and Hope. A figure of Neptune, in rose coloured carnelion, is detached, and its proper position cannot be determined. In the opinion of good judges this curious object represents twenty years' labour.

Manufactures.

Submarine and other Foundations. — An invention of Captain Thomas Bridges Heathorn, R.A., of 14, St. James's-square, London, has for its object improvements in the construction of submarine and other foundations in deep water, under the circumstances of a level, shelving, or sloping bottom of a varying density, possibly covered with mud, sand, or shingle to a great depth. The method of constructing the foundations for such structures upon a level bottom is as follows:—The caisson, which is of annular construction, with a triangular section, is made of sheet iron; the bottom portion is floated out to sea, exactly over the spot upon which the building is to be erected, and there anchored; concrete is then placed in the caisson, so as to cause it to sink equally, and, as soon as it is sufficiently deep in the water, an additional height of the caisson is fixed, and more concrete placed therein to sink it deeper. This operation continues until a firm foundation is obtained by the weight of the caisson with its interior filling of concrete causing it to sink through the mud or other soft ground to the hard ground beneath; the interior is then filled up with stone or concrete, upon which, and the concrete in the caisson, the superstructure is erected. For shelving or sloping bottoms the caisson will bear only upon the highest side of same, and to preserve the perpendicular of the said caisson, immediately it touches the hard ground, stones are placed in the interior of the caisson, which will naturally settle themselves in such position as to form a wall underneath that portion of the caisson which does not touch the hard ground, thereby forming a foundation upon which the caisson may rest. The mode of obtaining foundations in deep water will also apply to obtaining same in soft or peaty ground on land, and in some cases the interior filling of stones will be omitted, and the caisson allowed to sink until it is prevented from further movement by the internal apertures closing, as the building up of the inner side terminates in a conical apex.

Museum and Library of Industrial Art, Paris.— A new museum and library has just been commenced by the *Union Centrale des Beaux-Arts appliqués à l'Industrie*, which have already been referred to in a cursory manner in the columns of the *Journal*, and which are installed in a suite of rooms in one of the houses of the fine old square called the Place Royale. The collection is not yet very large, but promises well. The museum contains some admirable specimens of art manufactures, ancient and modern, including porcelain, faïence, terra-cotta, enamels, wood carvings; fine old tapestry work from Holland, with designs evidently borrowed from the East; some specimens of old book-binding, and a number of illuminations of great beauty. There are also many interesting objects of a miscellaneous character; amongst these are two or three examples of a kind of ornamental work that is rather rare, namely, chased bronze; bouquets of flowers and other ornaments being carved in high relief, apparently in the solid metal, or possibly cast and afterwards chased. These curious plates are of the time of Louis XIV. The library contains a large number of fine illustrated works of various kinds, and it was pleasant to read the names of Pupin, Owen Jones, and other English writers on artistic subjects, on several title-pages and backs. The most characteristic feature, however, of this department is a large collection of patterns that have been actually used in the manufacture of ornamental tissues and paper hangings; these occupy a very long range of large portfolios, and are peculiarly adapted for the class of students for whose benefit this establishment is specially designed. There are also some curious collections of old patterns and specimens of actual fabrics, and some paper hangings of the earliest period of that manufacture in France, copied apparently from chintzes which, as regards taste in design, neatness in execution, and brilliancy of colour, would lose nothing by comparison with a very large proportion even of the most beautiful works of that class produced by the able French manufacturers of the present day. A portion of the contents of the museum, and, probably, of the library also, are lent for exhibition by their owners, but the remainder have been purchased out of the funds of the society. It is a remarkable fact, especially in France, that this laudable institution is the result of purely individual exertion, the whole of the members of the committee of organisation, with one single exception, that of a banker, being artists or manufacturers—architecture, designing, mechanism, bronze work, ornamentation; carpet stuff, lace, paper hanging, furniture making, and goldsmiths' work being all represented. These far-seeing industrial artists, warned by the rapid progress made in other countries since the commencement of the era of international exhibitions, formed themselves into a society, with the title given above, in 1861, for the organisation of Exhibitions of Industrial Art, the first of which was held in that year in the Palais de l'Industrie, and the second in 1863, and announces a third, on a much larger scale, for 1865. The Museum and Library are very important results of the Society's action. At present, and till the end of the present month, the new Museum is open to the public, but it is intended for a place of study, not as a popular exhibition, and, being unaided by Government grant or the public purse, the committee will be compelled to charge a fee to the students; this is at present fixed at three francs (half-a-crown) a month. In addition to the use of the Museum and Library, the subscribers will have the benefit of courses of lectures and elucidations, to be given in the evening, by artists and others capable of guiding the students to a due appreciation of the contents of the museum and library, the proceeds to be employed in the augmentation of both. As regards the majority of the articles of modern manufacture, they will be renewed at intervals of three months, so that the young designer and workman will have an opportunity of studying and comparing the products of the present day as they appear. In speaking of the new Institution the other day, a Parisian journalist said:—"The Museum of South Kensington, the honour of England, had a more modest commencement than this." This is scarcely the fact, but the observation shows how the efforts made in our country in the direction of Industrial Art are appreciated abroad. This Society, although self-formed and self-supporting, has the countenance of the authorities; the museum has been visited by the Minister and Superintendent of Fine Arts, and the former has presented it with an admirable collection of sea weeds, arranged by an artist-designer, who presented it to the Emperor, in which the natural specimens are accompanied by samples of tissues, the designs for which have been derived from the types here brought into direct comparison with them. The courtiers of the Court of Catherine de Medicis, who once inhabited this fine quaint old square, little thought that a Working Man's Museum and Library would one day occupy the best floor of one of their courtly mansions.

Large Telescopes.—A fine reflecting telescope has just been sent from Paris to the Marseilles observatory; this instrument measures eighty centimètres, or 31·520 inches aperture; its focal length is five metres, or 5·470 yards; and it is moved by isochronate machinery. It is the work of M. Léon Faucault. The Toulouse observatory is having one constructed on still larger proportions.

Colonies.

Australian Diamonds.—Diamonds have from time to time been found in the Ovens district, Victoria. Two were recently found by a man named M'Gill, in Finn's claim, on the Woolshed. One of these is said to be worth about £8 in its present state. These make seven diamonds found in the same claim. There has never yet been any systematic search in the district for precious stones.

The Salmon Experiment.—We have to record an important event in the progress of the great salmon experiment. The parr artificially reared in Melbourne have been successfully deposited in a suitable stream. Mr. Ramsbottom, who brought the ova from England, reported to the Acclimatisation Society that the Yarra was admirably adapted for a salmon river—the more especially as better tributaries than the Watts and the Badger could not be wished for. The Council of the Society, remembering that the coming warm weather would greatly increase the difficulties of removing the fish, and being of opinion that it was of the greatest importance that the breeding depot should be within an easy distance of Melbourne, resolved not to detain Mr. Ramsbottom in exploring the Gipps Land and the other rivers which had been suggested as adapted for the purpose, but to authorise him to remove the parr to the Yarra with all possible speed. The particular spot which was selected is a point of the Badger Creek, about forty-five miles from Melbourne. Here a tank has been constructed, twenty-one feet long, six feet wide, and from two-and-a-half to four feet deep, the variation being intended to suit the fancies of the young fish for shallow or deep water. Through this tank a stream from the creek is made to run, and in it the parr will remain until, having developed into smolts, they are ready for sea, a date at least twelve months distant. The task of removing the parr was a very delicate one. The little fish were skilfully got together, and introduced to a travelling tank, which was swung from an improved universal joint in a light American waggon, while, so that the parr should not feel the change from a running stream, Mr. Ramsbottom sat by the tank throughout the journey aërating the water by dipping out cupfulls and pouring them back again. Leaving Melbourne at half-past three o'clock in the morning, the juvenile strangers reached their destination at half-past three the same afternoon; and, thanks to Mr. Ramsbottom's assiduity and to the skilful driving of the coach, only nine deaths occurred during the rough and long way. It is to be regretted that upon the parr being removed their number was found to be far less than it was supposed we were possessed of. Still, there is every reason to hope that there are enough in the Badger to secure the return of some of the grilse from the sea, and thus to render certain the success of the experiment. Thus far the work has gone on favourably. The past gives us confidence that in the end success will be attained. From Tasmania we hear good accounts of the parr deposited in the breeding ponds at Derwent; they are progressing favourably, but there will be no change to report until the advent of that mysterious instinct which prompts them seawards.—*Melbourne Argus.*

Granite.—A gigantic block of granite, thirty-six tons in weight, has been brought down to Melbourne from Harcourt (Victoria), in order to be worked into a monument, intended for erection over the remains of the explorers, Burke and Wills, in the Melbourne General Cemetery.

Post Office Service (Victoria).—The Victorian Government have proposed to establish a fortnightly service, in connection with the Peninsular and Oriental Company, at a cost of £50,000, one moiety of which they requested might be contributed by the colony. The New South Wales Government have, however, declined to co-operate with the Victorian Government in the establishment of the fortnightly service referred to. It still charges double postage for all letters sent to the United Kingdom by the mail steamers, notwithstanding the increased postage has been suspended in England. This step has caused much dissatisfaction, and has induced many persons who have a large correspondence to forward their letters to Melbourne for transmission. The other colonies continue to charge the old rate.

Coal in New Zealand.—The Provincial Government is exerting itself to promote the working of the West Coast coal fields; and two tons of coal from the Buller, and about twenty-five tons from the Grey, are now in Nelson, being got ready for shipment to London for the purpose of being tried and reported upon by the Board of Admiralty. Meantime, boring on the side of Mount Rochfort, near the mouth of the Buller River, is being carried on with a view of ascertaining whether, by a drive or a shaft, the coal can be got on that side of the mountain instead of at the back, where it crops out in thick seams. If the results be favourable a great saving in the cost of constructing a road from the coal to the mouth of the river will be effected. The coal from the Grey is highly bituminous and burns strongly; that from the Buller is a harder coal, and is supposed to be the best for the furnace. Boring for coal is also going on at Pakawau. We stated some time ago that at a depth of fifty feet an excellent seam four feet in thickness had been discovered, but the boring has been continued, and has now reached a depth of 98 feet. The parties interested are sanguine, from the indications of the strata, that they are approaching other seams of equal, perhaps greater, thickness than the one spoken of.

Obituary.

Charles Harriott Smith, an old member of the Society, died on the 21st of last October. He was born on the 1st of February, 1792. His father, a respectable stone mason, in the Portland-road, considering reading, writing, and arithmetic, as sufficient scholastic acquirements for his business, took his son from school at the early age of twelve years, to initiate him in the operations and technicalities of stone masonry; but he soon acquired a taste for the conversation of well-informed persons, some of whom, especially Mr. Bonomi, the father, and his friend, young Donaldson, encouraged his aspirations for higher pursuits. After working hours, he employed himself in drawing and modelling. This paved the way to his admission, as a student, to the Royal Academy, where, besides modelling and drawing, he applied his mind to the study of Grecian and Gothic Architecture. He became a member of the Society of Arts in 1814, when he was only sixteen years of age. If at the Royal Academy he acquired skill in the practice of his art, here he learned to reason and collect information. With what satisfaction, in after life, he would dwell on the discussions of Alexander Galloway, Bryant, Donkin, Brunell, and other able men, from which he derived much mechanical knowledge; from Britton, Brayley, and Strutt, he acquired a taste for archæological research; and in chemistry, mineralogy, and geology, he found valuable instructors among its members. Soon after his admission, the Duke of Northumberland, presiding, put a subject to the vote; seeing a youth of sixteen hold up his hand, his Grace asked if boys were allowed to vote; the answer was in the affirmative, and young Smith, proud of the privilege, was the more anxious to exercise it discreetly and honourably. He soon secured the good-will and growing esteem of many of the members, as Charles Warren, Horsman Solly, Britton, Varley, Brockedon, and of their excellent Secretary, Mr. Arthur Aikin. When the late Sir Charles, then Mr. Barry, was preparing to carry out his designs for the Parliament Houses, he felt a difficulty in obtaining an adequate supply of good stone, and proposed to Govern-

ment a survey of all the principal quarries in England and Scotland; fortunately, he became acquainted with Smith, through the late Joseph Hume, one of the Vice-Presidents of the Society of Arts; and the Royal Commission for this inquiry was composed of Mr. Barry, Sir Henry Delabeche, the well-known geologist Dr. William Smith, and the subject of this notice. Their examination of our ancient buildings, castles, and churches, and of the quarries whence the material had been drawn, was careful and judicious, and the report proved a valuable addition to our artist's professional knowledge. Mr. Smith's zeal and intelligence had won for him the esteem of his fellow-commissioners, and their friendship continued through life. Sir Charles Barry, having decided on the quarry that from experience, and from tests carefully made by Professors Daniel and Wheatstone, was best suited for his purpose; but aware that in every layer there are imperfect veins, proposed to Government to appoint Mr. Smith inspector of the stone as supplied by the contractors, in order that his practical knowledge should prevent any unsound admixture; unfortunately, false economy prevailed, the precaution was not adopted, and many inferior blocks were admitted, to the serious regret of all parties. Mr. Smith's sound knowledge was generally recognised; he was elected an honorary member of the Royal Institute of British Architects, to whose transactions he contributed many interesting papers. In later times he visited the quarries of Caen, in Normandy, in company with Mr. George Godwin, F.R.S., the interesting results of which soon after appeared in the *Builder*. He had become a sound authority on the subject, and all who had, or thought they had, a bed of valuable stone in their estate applied to him for his opinion, which he gave most liberally and honestly, too much so, perhaps, to agree with many ill-founded expectations, however candid and kind. As a writer and a lecturer he was clear and distinct; occasionally, but not often, a touch of humour or of ornament glittered for a moment. Some of his best writing is, perhaps, an essay on "Linear and Aerial Perspective," in Arnold's "Library of the Fine Arts;" an excellent treatise on an important subject of which he was thorough master, and which gave him a skilful and judicious execution of ornaments at the London University, the Royal Exchange, and other buildings. At the Royal Academy he gained the gold medal for the original architectural design in 1817, and continued for successive years to exhibit designs in architecture and models, and portrait busts and monumental compositions; but science, chemistry, geology, antiquities, and general knowledge, led him chiefly to scientific institutions, where his conversation was always acceptable. The year before his death, though suffering, he visited the Isle of Mull and Iona, and returned an enthusiastic admirer of the Scottish Royal monuments; but increasing infirmities prevented him from writing an account of them, for which his peculiar talents and knowledge so admirably fitted him.

Frederic Struve.—The celebrated Russian astronomer, whose name is associated with all the great works of triangulation and geodesy carried out in Russia and Eastern Europe, died on the 23rd of November, at St. Petersburg. He was born at Altona, in April, 1793, and studied philology, and afterwards astronomy, in the University of Dorpat, in the government of Livonia. In 1813 he was attached to the observatory of that town, becoming its director four years afterwards. In 1832 he removed to Pulkowa, and was appointed director of the magnificent observatory which the Russian Government had established there, which post he retained till his death. M. Struve undertook and carried out various important works and scientific expeditions, by a description of which scientific libraries are much enriched. His son, M. Otto Struve, studied under his accomplished father, and obtained the post of Second Astronomer of the Pulkowa Observatory.

Professor Benjamin Silliman, sen., expired at his residence, New Haven, U.S., on the 24th Nov. Mr. Silliman was the son of Gen. Gold Selleck Silliman, who rendered his country important service during the revolutionary war. He graduated at Yale in 1798, afterwards studied law, and was admitted to the bar in 1802. He afterwards accepted the chair of chemistry in Yale College, and visited Europe to prosecute his studies in a science which was at that time almost unknown in America. He returned after an absence of fourteen months, and published an interesting account of his travels. In 1807 he made a chemical analysis of a meteorite of great size and brilliancy which had burst in the town of Western, Connecticut. He afterwards assisted Dr. Ware in his experiments with the oxyhydrogen blowpipe, to which he gave the name of "compound blowpipe," by which it is commonly known. In 1818 Professor Silliman founded the *American Journal of Science and Arts*, better known both in Europe and America as *Silliman's Journal*, of which he remained senior editor till 1846. He was one of the earliest Americans to give popular lectures on scientific subjects. In 1830 he visited Europe a second time. He resigned his professorship in 1853, but continued to give lectures for two years longer. He was a man of simple tastes and active habits, and his old age was remarkably free from mental or bodily infirmity, and to the very last he took a deep interest in the progress of science, humanity, and freedom all over the world.

Publications Issued.

L'Architecture Privee au XIXme. Siecle sous Napoleon III., &c. Par M. César Daly. Folio. Paris: Morel and Cie.—The author of this work is well-known as one of the most daring and elegant writers on architecture in France, and yet, with the experience of what he has done before, the present publication is a marvel, and does high honour to the reign in which it is produced. It consists of three folios of engravings, in all about two hundred plates, executed on steel, in the most careful and artistic manner, representing select specimens of the architecture of the present day in France, divided under the three main heads of private houses or hôtels, houses constructed for being let out in separate tenements, as is usual in Paris, and villas or suburban residences. Each example is accompanied by plans and details, covering, in some instances, ten or twelve sheets, and each of the nine groups or sub-divisions is accompanied by what is called a parallel of plans, or, in other words, a collection of plans of other houses of the same class brought into comparison with each other. The elevations are drawn to a scale of one in a hundred, and the plans half that proportion, while the smaller details are given on one in four. It is impossible to exaggerate the beauty of the work in an artistic point of view. Every line is as clear as print, yet each elevation is a picture, but without anything extraneous being introduced. The cleverness of French architectural draftsmen is well know, and no work that we are acquainted with affords better examples of it than that under notice. It is a monument of drawing and engraving as well as of architecture. The letter-press which prefaces the work contains a good deal of matter of interest to others besides architects. M. Daly makes judicious remarks on the essential differences between public and private architecture, on the requirements of families with respect to accommodation and health, and on the peculiar demands arising out of French habits and manners, which he contrasts with those of England, a task for which he is peculiarly fitted, as having passed a considerable portion of his life in this country. Secondly, he treats the important question of the proper characteristics of art as applied to private dwellings, and where they differ from those which should mark the public edifices of a city. Thirdly, he sets forth a series of canons of construction, both as regards single and compound edifices;

and, lastly, he gives an elaborate estimate of the cost of the new houses in Paris and its environs, in all their details. The resumé of this portion gives us the following information:—Private mansions in Paris, of the first and second class, cost on an average, from 500 to 650 francs per mètre superficial, and those of the third class 400 to 450 francs; mixed residences in Paris, from 500 to 1,100 francs; and suburban residences from 400 to 600 francs. M. Daly boldly dedicates his work to Baron Haussmann, the prefect of the Seine, whom Paris wits call the Arch Destroyer, but whom M. Cesar Daly, and, probably, architects in general, regard as a special providence.

L'Etrurie et les Etrusques. Par Noel des Vergers. 2 vols. and Atlas. Paris: Firmin Didot.—This is the work of a learned and a travelled man, an original and important production. The first volume is devoted to the geology of Etruria, the origin of the Etruscans, their confederation in the plains of the Po, their commercial relations with the nations of Greece and Italy, their political constitution, their religious systems, and the development of the arts amongst them; the second volume traces the history of the nation from the foundation of Rome to the end of the Empire. The "Atlas" contains chromo-lithographic representations, beautifully executed, of the best known types of Etruscan vases, and each plate is accompanied by a commentary, in which the difficulties that surround the interpretation of the mythological figures and emblems of the period are discussed and explained. In addition to this the author has given a collection of epigraphic monuments, a comparative table of the Etruscan, Phenician, and Greek archaic alphabets; and an archæological chart of Central Etruria.

Works of the Etching Society of Paris.—The Société des Aquafortistes, now three years old, exhibits great activity and much talent, although some times a little eccentric, wanting rather in a nice appreciation of the line of demarcation between the comic and caricature, Amongst its recent productions is a graphical edition of the famous old legend of Marlborough, "Malbrook," full of riotous fun and sparkling with invention, an admirable example of the grotesque; the artist being M. A. de Boret. Another series of a very different kind, by M. C. Longueville, consisting of twelve plates of landscapes and marine pieces, exhibits a fine eye for effect and most careful execution. The young artists of Paris have taken up etching as a weapon against wood engravers and photographers, and they are perfectly right in so doing; the conflict cannot but be good for art, and none of the combatants are likely to suffer.

Report on various Hospitals of Geneva, Turin, and Milan. By Anthony Roulliet. This is a document addressed to the French Minister of the Interior, and is an instalment of the information which is being collected by a commission appointed by imperial decree, to inquire into the alimentary and sanitary systems of hospitals. The inquiry is intended to embrace all the hospitals of Paris and London, and also those of several other towns in France and other countries. The returns obtained from the French hospitals, with the aid of the authorities, are said to contain much important information; as regards London, it is said that nothing has yet been done. The author of the report in question is an advocate, attached to the commission, and was charged to collect information in Italy and Switzerland. The report is general in its scope, and includes, amongst other things, plans of the buildings, apparatus for ventilation, systems of washing, cleansing, baths, medical and pharmaceutical services, and tables of mortality.

Fabrication des Etoffes. Traite complet de la Filature du Coton. Par M. Alcan. Paris. This is an important work, in two parts, on the spinning and weaving of cotton and other textile fibres. The first part contains an investigation into the peculiarities of the fibres themselves, illustrated by microscopic sections; the cotton of Egypt, India, the Levant, and Algeria, and the proposed substitutes for that fibre, being especially considered. It includes also a history of the progress of the industry from the earliest known period. The second part is more specially technical, and includes a curious synoptical table of the transformations of fibrous substances, such as cotton, flax, hemp, wool, and silk. India rubber, the metals, glass, and bark, which are employed, or might be employed, as auxiliaries in textile manufacture; elaborate descriptions of machinery used; and a chapter on the establishment of mills, their construction, lighting, heating, ventilation, steam power, and cost. The work is illustrated by fifty plates and cuts.

Works of Alphonse X., of Castile.—The third volume of the works of this old astronomer has just been presented to the Paris Academy by M. Le Verrier, who calls attention to the curious fact that the path of the planet Mercury is there described as oval. Alphonse wrote in the eleventh century, and of course knew nothing of the laws of Kepler, but he had arrived at the conclusion that nothing but a kind of ellipse would represent the movement of Mercury.

Notes.

Education of Gardeners.—The Royal Horticultural Society has just issued its programme for the ensuing year; and members of the Society of Arts will see with satisfaction the announcement made respecting the education of gardeners, as follows:—"Examinations and Certificates for Gardeners.—Central Examinations of Gardeners in Theoretical and Practical Gardening will be held annually at South Kensington, and Local Examinations will be held in the country. Certificates of competency and prizes will be awarded at both Examinations."

A Chimney, about 100 feet high, comprising about 90,000 bricks, and estimated to weigh over 200 tons, was recently moved a distance of 100 feet in Worcester, Massachusetts, without breaking a brick.

Railway in Brazil.—A new railway has recently been opened in Brazil, which crosses the mountain chain, Serra-do-Mar, and connects the interior fertile plains with the sea-coast. It is eighty-eight miles long, and attains, in the course of five miles of mountain-steep, an elevation of 2,600 feet. The entire ascent is divided into four lifts, or inclines, of a mile and a quarter each, running at a gradient of one in ten. A level platform, or "bank-head," marks the summit of each incline, and at the upper end of the platform is a stationary engine. This engine has double cylinders of twenty-six inches diameter, with a five-feet stroke, and has been calculated to haul up fifty tons at the rate of ten miles per hour. Five boilers, of the Cornish description, are placed with each engine. On the upper half of each incline there is a double line of rails, with arrangements for passing-places on the middle of each of these lifts. A single line of rails then run on from the centre to the foot of each of the four divisions into which the ascent is divided. A steel wire rope, $1\frac{1}{8}$ in. diameter, is made for pulling up the ascending trains. This rope, tested to a weight far exceeding the requirements that will be made upon it, passes over friction-wheels, and is attached to the fly-wheel shaft. The inclines are partially self-acting, at the same time passing one train down to the foot of the Serra and drawing up another to the higher levels on its way out to the province beyond.

A Locomotive from Spain has passed through the Pyrenées into France, along the new series of tunnels, about forty miles in length. This was merely a trial trip, and it was perfectly successful.

RAILWAY BRAKE.—An experiment was lately tried to ascertain how quick a railway train under full headway might be stopped. It was allowed to attain a speed of fifty miles an hour, when the brakes were applied and the steam shut off. It came to a dead stand after running about 500 yards, being 60 yards more than a quarter of a mile.

SUBSTITUTES FOR CRANES AND HODMEN IN PARIS.—The *Builder* states, that "some of the contractors rebuilding the demolished houses, and running up quickly new mansions, have hit upon an ingenious way of raising materials to the top of the scaffold. As the head of water at the Villette is enough to command any of the houses in Paris, they have simply a pipe turned on from the main up to the top of the intended structure, and by that means can fill a bucket or large tub, which in descending draws up a plateau on which the materials are placed. The water, being turned into mortar, and otherwise made use of afterwards below, is not lost. Some of the materials are also hoisted by Lenoir's machine (by gas); there is one at work at the Rond Pont de Corcelles, close to the Avenue de Ternes. It seems to be, by timing a weight ascending a certain height, about $2\frac{1}{2}$-horse power. The absence of a boiler in these engines is a strong argument in favour of employing them where steady slight power is required. At all events, if they are not endowed with the abundant force of a steam-engine, yet in towns and confined streets, where only a moderate source of power is required to act in a small compass, noiselessly and without nuisance, we have seen that the required mechanical effect can be accomplished without risk of explosion, and consequent damage and loss of life, either to owners or their neighbours. That is something, at all events."

TECHNICAL EDUCATION IN FRANCE.—The *Société Philotechnique*, for the gratuitous instruction of workmen, is of some years' standing, and has branches in all parts of the capital. The other day there was a meeting of the Suresnes section, when M. Glachant, the Chief Secretary of the Minister of Public Instruction, presided, and made a remarkable speech. This gentleman has evidently studied the subject—technical education—both at home and abroad; he told the assembly that reading, writing, and arithmetic, were not learning, but merely means for acquiring education, and that the present state of society demanded for the workman a knowledge of the principles of his art, without which he ran great danger of becoming a mere slave of mechanism, the machine which he should direct. The remarks concerning what had been done abroad showed how carefully France watches what is going on elsewhere. In Belgium, said M. Glachant, with a population of four millions, there are no less than 1,145 adult schools, of which 27 meet in the day-time, 173 in the evening, and 945 on Sunday, the total number of scholars being 180,000. At Ghent there are more than 40,000 weavers, and not a single industrial school—the evening schools supply all that is wanted. In Russia education is obligatory until the age of sixteen; after that the youths attend the schools of Art and Industry (Gewerbschulen). The Sunday schools of Barmen and Eberfeld were established by a generous Frenchman, but the authorities of the latter place aided with a vote of 600,000 francs (£24,000). But the example of England occupied the greater part of M. Glachant's attention, not only on account of the amount of effort made, but also for the originality of the form as regards the Literary, Scientific, and Mechanics' Institutions, which are certainly unique in Europe. The influence of these is illustrated by the fact of "700,000 francs being raised for some special object by voluntary subscription in one day at the Manchester Mechanics' Institution, and by the act of the Society of Arts in obtaining the guarantee for the Exhibition of 1862. M. Glachant applauds the system of the introduction of music and other means of recreation into our popular institutions, and says:—"As our neighbours have borrowed the word Soirée from us, let us borrow from them the thing to which they have applied it." But it is the Kensington Museum which calls forth M. Glachant's warmest encomiums. He calls it the "Babylonian museum of South Kensington." He gives the statistics of the schools there and in connection with it; he speaks of the acts of the Committee of Council of Education as "the most gigantic effort ever made in aid of industrial art and the generalization of practical instruction." "On the morrow of the Exhibition of 1862," he says, "a cry of alarm arose amongst our workmen (the French) that England had moved!" His concluding remarks are for all the world:—Pupils of the Philotechnic Association, it is not necessary to show you that your rivals are doing their best to cause you to exert yourselves. You will soon learn, if you have not already, all the secrets of your professions. On this head you might teach your professors. Still you will listen to those men who have never handled a tool, for you know that they can aid you in becoming more expert; for increased intelligence gives the hand more hardihood and dexterity. An ignorant workman dare not depart from an old bad system; but he who has learnt to reflect searches and finds improvements and new applications, which often produce revolutions in industry."

FINAL DEMOLITION OF THE EXHIBITION BUILDING.—On the 12th instant, at half-past eleven, the whole of the central entrance in the Cromwell-road was brought to the ground, being the last appearance of any part of the Exhibition building. The public will recollect what an enormous mass of brick-work this was. Some of the piers were twelve feet in thickness. Having been prepared beforehand, by the sappers, under command of Lieut. Knocker, a hundred-and-twenty-pounds of gunpowder in as many separate charges, distributed at the footings of the whole mass, were fired simultaneously by two electric batteries. The charges had been so arranged, and the calculations so made, as to cause the whole mass to fall inwards towards the north; and the mass was obedient to the laws of science, so that not a brick tumbled in the Cromwell-road. The greater part of the northern side gradually subsided to the ground, leaving momentarily a large portion, which was projected inwards, by the fall of the Cromwell-road front upon it. As soon as the smoke and dust had cleared away the western tower was seen to be standing. Gradually the sappers approached to find out why it had not fallen like the rest. They had scarcely reached it before it began to vibrate, and in a second afterwards fell like the other portions. Each part of the towers and great arches of the Exhibition building have thus afforded a series of the most valuable experiments, and it is said that the data obtained considerably modified those which formerly were accepted. The experiments have lasted about three months, and the delay, which some persons did not understand and complained of, is now fully explained by the successful work of last Monday. The members of the Society of Arts will be glad to be informed that a paper on the subject, by Lieut. Knocker, will be read in the course of the session.

CONSUMPTION OF SUGAR IN ENGLAND AND FRANCE.—Official documents show that the consumption of sugar in 1863 in England and France was as follows:—England, 480,000 tons; France, 260,000. The average consumption for the four years—1846 to 1850—was respectively 280,000 and 112,000 tons, and for the four years—1850 to 1854—357,000 and 119,000 tons. The consumption has consequently doubled within 18 years—a fact of some importance, the consumption of sugar being held a conclusive test of material prosperity.

CANADIAN journals are agitating the subject of a grand Provincial Exhibition, in which the two Canadas shall unite in offering 20,000 dols. in premiums, and challenging New York State to enter the lists in competition therefore. It proposes, as an inducement for exhibitors from long distances, that premiums be offered for leading products

of the manufacturing and agricultural interests only, so that they would tempt a large competition. It is asserted that leading agriculturists of Lower Canada are anxious to bring about such a joint exhibition.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Arts, 8. Cantor Lectures. Mr. B. Waterhouse Hawkins, "On the Reproduction of Natural Forms by Art and Manufacture." Lecture II.
British Architects, 8.
Medical, 8. Mr. Hunt, "On the Present State of Medical Logic."
R. Asiatic, 3.

Tues. ...Civil Engineers, 8. Annual General Meeting.
Statistical, 8. Mr. James Heywood, "On the Extension of Modern Subjects as a part of Regular Study in Educational Institutions."
Pathological, 8.
Anthropological, 8.

Wed. ...Society of Arts, 8. The Articles sent in Competition for the Art-Workmanship Prizes will be Exhibited, and a Report in connection therewith will be read.
Geological, 8. 1. Mr. W. Keene, "On the Coal-measures of New South Wales with Spirifers, *Glossopteris*, and *Lepidodendron*." Communicated by the Assistant-Secretary. 2. Mr. Searles V. Wood, jun., "On the Drift of the East of England, and its Divisions."
London Institution, 7.

Thurs...Royal, 8½.
Antiquaries, 8.
Philosophical Club, 6.

Patents.

From Commissioners of Patents Journal, December 9th.

Grants of Provisional Protection.

Butts of bent iron plates, machining the ends of—2900—T. W Penton and H. Penton.
Carbonizing wood, apparatus for—2884—M. Henry.
Cash samples, bags for containing—2910—G. Kottgen.
Cigar holders, butt-pieces for—2928—A. Oberdoerffer.
Coal, &c. machinery for getting—2929—P. Haggie and A. Gledhill.
Coal, distillation of—2484—J. G. Beckton.
Colours, apparatus for stamping—2911—H. L. Maquet.
Colouring matter, manufacture of—2916—J. C. L. Durand.
Engine, rotary—2751—W. Thrift
Fire arms, breech loading—2951—C. Reeves.
Fire arms, breech loading—2983—W. J. Matthews.
Gold leaf, &c., manufacture of—2872—J. H. Johnson.
Guns, working of—2882—T. A. Blakely.
Hats, manufacture of—2887—W. Wilson.
Hats—2971—A. I. L. Gordon.
Hauling apparatus—2961—G. Newsum.
Heating rooms, boilers for—2828—T. Jones.
Heating apartments, fire-places for—2901—W. E. Newton.
Heatings rooms or buildings, apparatus for—2949—J. Grundy.
Horse hoes, &c., construction of—2881—W. Sargent.
Iron tubes, manufacture of—2877—J. Fisher.
Iron and steel, apparatus for manufacture of—2904—J. Griffiths.
Jacquard cylinders, improvements in—2866—J. Hughes.
Knitted or looped fabrics, machinery for—2886—J. Webster and J Langham.
Lace, manufacture of—2302—S. Bates.
Lamp—1902—A. Kistemann.
Liquors, apparatus for drawing off—2880—J. Behrends.
Mathematical instruments—2895—J. Pitman.
Motive power—2779—G. A. Galloway.
Motive power—2989—A. Hawkes.
Moulding and planing wood, machinery for—2875—H. Wilson.
Mules for spinning—2922—J. Paley.
Navigable vessels, motive power for—2890—E. S. Jones.
Paper pulp, apparatus for manufacture of—2896—J. Easton, jun.
Paper hangings, gold, apparatus for manufacture of—2909—J. Wylie.
Paraffin, &c., lamps—2871—T. Rowatt.
Paraffin oil, apparatus for drawing off—2981—R. F. Dale.
Photographic processes—2953—L. Crozat.
Piled fabrics, method of weaving—2908—H. Eckersley.
Pipes and tobacco, cases for carrying—2898—W. Palmer, jun.
Power engine—2918—T. M. Brisbane.
Presses for baling—2578—W. Clark.
Preserving ships' bottoms—2985—H. Caunter.
Pressing and baling goods, machinery for—2979—A. V. Newton.
Projectiles, manufacture of—2853—J. P. Nolan.
Pulp, preparation of—2913—W. Ibotson.
Railway trains, communication between passengers, guard, and drivers of—2935—R. Wheble.
Railway trains, communication for travellers with the guard—2868—R. W. Sievier.
Revolvers—2513—I. Williams.
Roads, sweeping, machines for—2975—G. Davis.
Rock and stone, machinery for excavating—2914—P. E. Gay.
Sails, reefing and furling—2915—T. Shorley and G. Gibson.
Sewing machines—2902—W. Martin.
Sewing machines, winders for—2903—H. Willis.
Ships' anchors—2878—S. Sharp.
Signals—2710—R. C. Robinson.
Signals, &c., apparatus to exhibit—2926—J. S. Gisborne.
Sleepers for railways, machinery for sawing—2874—H. Wilson.
Smoothing and polishing, apparatus for—2930—G. Brunton.
Spirituous liquors, distilling and purifying—2973—C. J. Falkman.
Steam boilers, prevention of accidents with—2891—J. Phillips.
Steam boilers or generators—2893—A. H. Stott.
Steam hammers, &c.—2917—R. Morrison.
Steam in steam engines, regulating the flow of—2888—J. Petrie.
Steel castings, manufacture of—T. E. Vickers.
Studs, buttons, &c.—2956—L. A. Waldemar.
Sugar, manufacture of—2906—A. V. Newton.
Sugar, turbine for drying—2965—L. Montaigue.
Torpedo rams—2799—G. A. Henty.
Travelling railways—2931—E. Molyneux, jun.
Vapour, cold, apparatus for creating—2889—S. Piesse.
Vent pegs and valves—2905—S. Bourne.
Washing, &c., apparatus for—2919—N. Hodgson.
Weaving, looms for—2897—J. Gaukroger.
Weaving, looms for—2955—C. Hartley.
Weaving, looms for—2991—R. L. Hattersley.
Window sashes, apparatus for lifting—2924—S. Price.

Inventions with Complete Specifications Filed.

Gas, illuminating, manufacture of—3042—G. T. Bousfield.
Infant tender and exercising apparatus—3019—G. Haseltine.

Patents Sealed.

1445. W. H. James.	1499. G. Newton & J. Braddock
1456. W. Sharp.	1507. W. Clark.
1459. W. E. Gedge.	1517. E. M. Boxer.
1460. W. Martin.	1524. J. C. Brentnall & R. Edge
1461. R. A. Brooman.	1526. John Jobson.
1465. E. Pope.	1533. W. A. Abegg
1468. J. Brown, T. Way, and T. M. Evans.	1535. J. Thompson
	1604. John Askew.
1469. G. A. Burn.	1630. R. Balans.
1477. W. Dawes.	1946. G. F. Druce.
1487. G. Gondelfinger & J. L. Bichet.	2006. W. Brenton.
	2472. G. Haseltine.

From Commissioners of Patents Journal, December 13th.

Patents Sealed.

1472. W. Tregay.	1514. W. H. Tooth.
1473. P. B. O'Neill.	1515. T. Agnew, jun.
1478. C. Taylor and J. Dow.	1518. W. Whiteley and G. Harling.
1482. R. A. Brooman.	
1485. J. Fletcher and H. Bower.	1528. G. Beard.
1488. J. Lancelott.	1529. J. H. Beattie.
1489. W. E. Gedge.	1538. W. J. Pughsley
1493. R. W. Thomson.	1558. C. H. Pugh.
1494. M. A. Muir & J. McIlwham.	1592. W. Brown.
1498. G. H. Ozouf.	1609. W. F. Thomas.
1503. W. C. Jay.	1646. A. V. Newton.
1505. G. B. Morris, W. B. Price, and J. L. George.	2221. E. O. Potter.
	2305. W. Wilkinson.
1512. J. J. Bennett.	2590. W. Snell.
1513. W. H. Tooth.	

Patents on which the Stamp Duty of £50 has been Paid.

3060. J. D. Napier.	3094. V. L. Daguzan.
3072. W. N. Hutchinson.	3208. W. M. Williams.
3130. T. Walker.	2099. D. Vogl.
3083. R. A. Brooman.	3106. R. A. Brooman.
3110. J. Leeming.	3108. W. H. Tooth and W. Yates.
3078. C. F. Varley.	3119. J. W. Scott.

Patents on which the Stamp Duty of £100 has been Paid.

1702. W. A. Gilbee.

Registered Designs.

Military Shoulder Sash—Dec. 2—4676—Thompson and Son, 11, Conduit-street, W.
Furniture of a Box or Cash Chest—Dec. 3—4677—James Ferry and Son, 2, Old Fish-street-hill.
The Fittings of a Box, Case, or Chest—Dec. 5—James Ferry and Son, 2, Old Fish-street.
The Shape or Configuration of a Sewing Machine Needle, to be called "The Crispin Needle"—Dec. 6—4679—Hollington and Son, Astwood Bank, Worcestershire.
Faucet for Drawing Liquids—Dec. 12—4680—Charles Bone Clark, Birmingham.

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AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, DECEMBER 23, 1864. [No. 631. Vol. XIII.

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Announcements by the Council.

Cantor Lectures.

"On the Reproduction of Natural Forms by Art and Manufacture." By B. Waterhouse Hawkins, Esq., F.G.S., F.L.S.

Jan. 16th, 1865.—Lecture III.—On the varieties of artistic treatment of the forms of animal and vegetable life—pictorial representation; conventional ornamental, allegorical, and symbolic combinations of animal forms.

Jan. 23rd.—Lecture IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

Jan. 30th.—Lecture V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra-Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. A set of tickets for this purpose has been sent to every member.

Art-Wokmanship Prizes.

The Articles sent in competition for the Art-Workmanship Prizes are now arranged for display in the Society's Great Room, and the Members of the Society, as well as Art-Workmen, are invited to inspect them on and after Monday next, the 26th instant, between the hours of 10 and 4. To suit the convenience of Artizans, it is the intention of the Council to open the rooms on several evenings, the dates of which will be advertised as soon as arranged.

Proceedings of the Society.

Cantor Lectures.

Second Lecture.—Monday, Dec. 19.

Mr. Hawkins first mentioned the fact, that though the union of art and manufactures had been termed by the artist and lecturer Hayden, an "unholy alliance," it is not so in reality, but it is a natural and necessary union, only rendered "unholy" by the war between designer and manufacturer, which is caused by the ignorance on the part of the artist of the inevitable conditions of the material in which his work is to be produced, and the process by which it is to be multiplied, multiplication being the means by which objects of art are put within the reach of the public. Mr. Hawkins then called attention to a shield, lent by Messrs. Elkington, the original price of which was £500, but which, by the happy co-operation of artist and manufacturer, has been multiplied so successfully that it is now offered to the public at less than £20.

Having continued his argument on the subject of art education, Mr. Hawkins proceeded to illustrate his assertion, that a knowledge of the structure of the object which he had to represent was necessary to the artist, by showing, that if the Board of Trade were to employ an artist to represent the positions of a locomotive engine whenever accidents occurred, the first requisite for such a person would be that he should possess a thorough knowledge of the structure of a locomotive engine; and if this were necessary, how much more necessary would it be that an artist, wishing to represent an animal, should possess a knowledge of the structure of animals, which are so much more varied in their attitudes than any steam engine could be even under the most peculiar circumstances of an accident. The lecturer compared the furnace of an engine to the stomach of animals, the heat and blood to the steam, and the cylinder and valve to the lungs, thus showing a parallel for three of the great elements of the animal structure; but he further pointed out that there is in the living being a fourth element, namely, the will, represented by the brain, and conveyed over the whole body by cords which might be compared

to the electric telegraph. This fourth element, being unrepresented in the machine, has to be supplied by a man, who acts as brain to the steam engine, controlling its force, and bringing it into subjection for his own uses. Having sketched on his black canvass a locomotive engine, and the internal structure of a vertebrate animal, Mr. Hawkins observed that this plan of structure is the one plan upon which all vertebrate animals, from the creation even until now have been constructed, the Creator's first design being so perfect as to have been susceptible of every modification necessary to the varied conditions of life on the earth, and in the air and water. By the alteration of a few chalk lines, Mr. Hawkins converted his sketch of a fish into a seal, and from a seal to a deer. He also observed that the unity of plan in animal forms is a great advantage to the artist, so that when he has thoroughly mastered the structure of a typical vertebrate animal, it becomes a comparatively easy task for him to acquaint himself with its various modifications. It is not enough that a draughtsman should imitate the appearance of an animal when he can get one to stand still for him; it is necessary that the designer should be able to represent animal forms in any of the varied attitudes which they may assume without their being present to his corporeal eyes, and this he can only do by being thoroughly acquainted with their structure, with the space occupied by the various parts, and the proportion which they bear to one another. By the system now adopted in art schools the hand of the artist only is educated, and his work is therefore merely imitation, not representation. If the mind of the artist be educated he will possess efficient power to control the movements of his hand, which is made by God to express man's will; and even when the right hand is injured the mind of man has efficient power over the left to compel it to express his will with equal accuracy. By spending his energies in acquiring mere power of handling, the artist neglects his mind; his inventive faculties are not developed; and, instead of enhancing the value of manufactures, which is the true province of decorative art, it is, by this fault in education, lowered in its character, and art thus becomes an enemy to manufactures.

Sixth Ordinary Meeting.

Wednesday, December 21st, 1864; William Hawes, Esq., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Haines, Alfred, Kensal-house, Harrow-road, W.
Knowles, S., Tottington, near Bury, Lancashire.
Mayson, J. S., Charlotte-street, Manchester.
Peacock, Edmund, 18, Holford-square, Pentonville, W.C.
Tremlett, Rev. Francis W., LL.D., the Parsonage, Belsize-park, N.W.
Whitehead, J. B., Rawtenstall, Lancashire.

The following candidates were balloted for and duly elected members of the Society:—

Abel, Charles Denton, 20, Southampton-buildings, W.C.
Brinsmead, Henry, 12, Rathbone-place, W.
Sharp, Philip Henry, 18, East-parade, Leeds.
Simonds, Professor James B., Royal Veterinary College, Camden-town, N.W.
Simpson, J. Hawkins, 40, Bedford-place, Russell-square, W.C.
Smart, James Joseph, Secretary of the United Service Club, Pall-mall, S.W., and 3, Lambton-terrace, Westbourne-grove, W.
Sundius, Charles C., 54, Picadilly.
Thompson, Frederick, Urmstone Lodge, Wimbledon-park, S.W.
Varnell, Professor George, Royal Veterinary College, Camden-town, N.W.

The following Institution has been taken into Union since the last announcement:—

Clitheroe, Mechanics' Institute.

The articles sent in competition for the Art Workmanship Prizes offered by the Society, were arranged in the room for the inspection of the members.

The Paper read was—

A SHORT REVIEW OF THE SOCIETY'S PAST AND PRESENT ACTION IN THE PROMOTION OF INDUSTRIAL EDUCATION.

By S. T. Davenport, Esq.

The address read by the Chairman of the Council at the opening of the present Session, and the remarks made upon it by the Vice-Chancellor (Sir William Page Wood) and other members, has led me to review the various steps which have been taken since the incorporation of the Society by Royal Charter, in the promotion of Industrial Instruction. I have endeavoured to record the facts as they have occurred to my mind, and I have also appended a few suggestions with reference to what appears to me to remain to be done by the Society, in order to complete the course of action upon which it entered nearly 20 years ago—a course which has gradually become enlarged, and which I believe, if carried out to completion, will add not only to the present popularity of our Society, but so strengthen the body and increase the individual interest of members in its action as to place it in a firmer and more abiding position than it has ever yet attained to, at the same time that it will add to the many claims which it has already advanced, and which have obtained for it so large an amount of approbation and public support.

It appears to my mind that the secret of the Society's success since its incorporation has been the constantly progressive educational course of action which it has pursued. In reviewing the objects for the promotion of which the Society of Arts was established, I find them recorded in the address from the Council on the opening of the 93rd Session, 1846-7, (being the first address after the incorporation of the Society) as follows:—"It was the remark of our Royal President, the Prince Consort, made to a deputation from your Council when waiting upon him on the business of the Society, that the department most likely to prove immediately beneficial to the public would be that which encourages most efficiently the application of the Fine Arts to our Manufactures. The manufactures of this country have, he observed, attained an eminence for solid execution, for perfect finish, for mechanical accuracy, and for cheap production, which distinguish them in these respects beyond those of any other country. But there are some countries that excel ours in the beauty of design, in the perfection of colouring, in symmetry of form, in elegance of pattern; it is the application of the art of design to the mechanical manufactures of this country that is alone requisite to enable her to stand without a rival. Of high art in this country, there is abundance; of mechanical industry and invention an unparalleled profusion; the thing still remaining to be done is to effect the combination of the two—to wed high art with mechanical skill. The union of the artist with the workmen in general—this is a task worthy of the Society of Arts, and directly in the path of its duty." Such were the sentiments expressed by the Prince, our president; such also are the views which have guided your Council in their proceedings during the last year. They have reason to think that this is one of the most promising and valuable spheres of future usefulness to the Society. In accordance with these views, the Council recommended and issued premiums to a large amount for the production of decorative

designs and models. The result of them was, to produce a large series of models of great merit, many of which were rewarded, and some of which have been extensively manufactured and introduced into general use. The Council augur favourably from the success of their first effort in this direction, and expect increased success in the following Session. They therefore propose in this Session very much to extend their list of prizes in the department of decorative arts and manufactures. They much regret that hitherto the artist and the manufacturer have been kept so far asunder; but they rejoice that the Government has already, by establishing Schools of Design, shown its sense of the importance of combining Art and Manufacture. They believe this alienation of natural allies to be most detrimental to both; they believe that it is not vulgar art which ought to be applied to common articles of manufacture, but they believe that the higher the artistic talent called into requisition by the manufacturer the more successful it is likely to become; they believe also that one great means for the promotion of Art and the cultivation of taste, is to surround as much as possible with common objects of beautiful forms, so as to educate the people by the habit of looking on good designs and elegant proportions." To educate the people by the habit of looking at good designs and elegant proportions, was the first object to be attained by the Council, and this they endeavoured to effect by inducing manufacturers to produce articles of every-day use of simple but elegant forms, and, when combined with colour, of a harmonious and artistic character, thereby diffusing a taste and knowledge of Art, and inducing a love for the symmetrical and beautiful by supplying, in cheap materials, of elegant form, objects suited to the familiar uses of every-day life. Having succeeded in inducing the manufacturers to produce artistic designs, the public had next to be taught to appreciate and to purchase them. This object was attained by means of the Exhibitions which were then established, and the first of which, viz., an Exhibition of Select Specimens of British Manufactures and Decorative Art, was opened on the 3rd March, 1847. While pursuing the above course outside the Society, the attention of members within was directed to kindred subjects by means of papers read at its meetings, on Ancient and Modern Art, on the First principles of symmetrical beauty and their application in certain branches of the art of design, on the Harmony of colour, &c.

The success of these efforts grew day by day, and at the close of the session in 1849, we find the Society actively promoting the Great International Exhibition which was held in 1851, an exhibition, the educational value of which cannot be over-stated. But in order that the British manufacturer might not be unduly distanced by foreign competitors, the Society suggested, in the early part of the session 1848-9, that an exhibition of ancient and mediæval art should be held, "to enable the workman of our days narrowly to inspect the productions of his predecessors, executed in times, and under circumstances, which admitted of more careful artistic elaboration than do those in which we are living, and would be highly instructive to manufacturers in their preparation for the Grand Exhibition of 1851."

The Society's efforts to promote an extended knowledge of art and industry, however, did not stop here, nor was it limited to artistic designs and manufactures, for in the same year (1849), in anticipation of the Great Exhibition of 1851, a new series of exhibitions was instituted, the object of which was to place before the engineer, the mechanic, the manufacturer, and the workman, the improved appliances introduced with a view of meeting the requirements of the times, and to give publicity to the productions of "the artisans and mechanics—a class of inventors whose efforts had not at that time had the publicity given them which the Council conceived it is one of the great purposes of the Society of Arts to afford them." Nor did the Society cease its action, or consider it had fulfilled its mission, when it had attempted to educate the people; induce manufacturers to produce; instructed the workman; and given publicity to the inventions of the artisan and the mechanic. No; new fields for usefulness presented themselves—the Exhibition of 1851 was about to take place—the scientific and artistic skill of our foreign and continental competitors was known—the appreciation of Art by the public, and the desire of manufacturers to produce more perfect specimens of industrial art, was also known; but it was felt that in this country the artist-workman was far behind his foreign competitor, and the Schools of Design were, in effect, little more than a name.

It is not necessary that I should recapitulate all the steps taken by the Society which ultimately led to the Great Exhibition of 1851; suffice it to say that, in the first instance, it found contractors who were willing to provide the necessary funds for the erection of a building, a prize fund, and all other costs and charges incidental to the undertaking; that having obtained for the object a large amount of public support, it became necessary to transfer the management of the Exhibition to a body of noblemen and gentlemen, who were incorporated for that purpose by Royal Charter, bearing date the 15th August, 1850. Of the Exhibition itself, the Commissioners state, in their first report, "of the general admiration excited by the display, it would be superfluous for the Commissioners to give any account; of the beneficial effects which may be anticipated from a spectacle so novel and so wonderful, this is not the place to speak. It will be probably long ere the impulse it has given to industry and civilisation will have reached its highest point, and it is not too much to hope that it will be ages ere that impulse will cease to be felt."

The Exhibition having been closed, we find the Society again at work, anxious to give effect to the lessons taught by the display; and in October, 1851, a letter was received from His Royal Highness Prince Albert, suggesting that in order to the attainment of those advantages to Art and Industry, which it was the object of the Exhibition to endeavour to procure, they would be best effected by a series of lectures on the probable bearing of the Exhibition on the various branches of Science, Art, and Industry. Lectures were accordingly delivered before the Society, the subject selected by Dr. Lyon Playfair for his lecture being the "Chemical Principles involved in the manufactures shown at the Exhibition, as a proof of the necessity of an Industrial Education," in the course of which he states, that, having shown in a former lecture—'On the National Importance of Studying Abstract Science, with a view to the healthy progress of industry—that a rapid transition is taking place in industry, that the raw material, formerly our capital advantage over other nations, is gradually being equalized in price, and made available to all, by the improvements in locomotion; and that industry must in future be supported, not by a competition of local advantages, but by a competition of intellect. All European nations, except England, have recognised this fact. Their thinking men have proclaimed it, their governments have adopted it as a principle of state, and every town has now its schools, in which are taught the scientific principles involved in manufactures, while each metropolis rejoices in an Industrial University, teaching how to use the alphabet of science in reading manufacture aright. Were there any effects observed in the Exhibition from this intellectual training of industrial populations? The official reserve necessarily imposed upon me, as the commissioner appointed to aid the juries, need exist no longer, and from my personal conviction I answer without hesitation in the affirmative. The result of the Exhibition was one that England may well be startled at. Wherever—and that implies in almost every manufacture—Science and Art were involved as an element of progress, we saw, as an inevitable law, that the nation which most cultivated them was in the ascendant. Our manufacturers were justly

astonished at seeing most of the foreign countries rapidly approaching, and sometimes excelling us in manufactures our own by hereditary and traditional right. * * *

"It is well to inquire in what we are so deficient, and what is the reason of this deficiency. Assuredly it does not consist in the absence of public philantropy, or want of private zeal for education; but chiefly rests in that education being utterly unsuited to the age. * * *

"You may, and I hope will soon, raise an Industrial University, but this should have its pupils ready trained before it adopts them."

Professor Edward Solly, F.R.S., in his lecture on the "Vegetable Substances used in the Arts and Manufacturers, in relation to Commerce," pointed out how the Society of Arts was for a long time the only public body in this country established for the promotion of Industrial Art, but also called attention to the importance of establishing an Industrial Museum, "a place of reference, in which useful knowledge of all sorts would be acceptable to every one, and at all times available for purposes of instruction;" and the Professor concluded his lecture as follows:—"With those who say that we need an enlarged and comprehensive system of national education, I agree heart and soul; but I would even go farther—I say let us have the means of teaching the schoolmaster as well as the scholar; let us, by collecting facts and useful information, obtain those means of instruction in applied science, which are at present almost wholly wanting." Such, in fact, was the universal cry raised by all who studied the Exhibition of 1851. Each lecturer, in his own special department, proclaimed the great want of England, as shown by the Exhibition, to be an increased, national, scientific, and industrial education. The Society of Arts felt the force and truth of the declaration, but it also felt that, before it could step in and aid the scientific education of the industrial classes, it was necessary that the standard of their education should be raised; and we accordingly find that the Council accepted the proposition submitted to it by Mr. Harry Chester, for establishing a Union of the Mechanics and Literary Institutions of the country, a Union which was at once effected, and the successful working and educational advantages of which, to the industrial and working classes, as well as to the Institutions themselves, has beeu a source of constant congratulation, both in the Council and among the members of the Society. Concurrently with this movement, the Society took steps to establish elementary drawing and modelling schools for artizans and mechanics, and appointed a Committee to carry out the object; and with this view a deputation visited Bradord on the 2nd of February 1852, in accordance with an invitation as set forth in the notice of proceedings issued to the Society at that time, and which was as follows:—

"The Great Exhibition has materially strengthened a growing conviction that one of the most serious disadvantages under which original British manufactures are produced is the want of artistic knowledge and executive ability on the part of the artizans engaged in producing them. Every one competent to judge, admits that the ornamental productions of the French exhibit much more ability on the part of the French workmen in drawing, chasing, &c., than our own. The Council believe that a radical cure for many imperfections of British manufactures, will be found in a much more enlarged and liberal system of art education than at present exists, an education which shall make the power of drawing at least as easy to be acquired as that of writing, and shall begin at an early period of life. The Council are convinced that there is hardly any handicraft in which a workman can be engaged, as a carpenter, mason, smith, &c., which would not be greatly improved by an ability to perceive the form of objects correctly and represent it with precision. At present schools of design are supported partly by a government grant, partly by students' fees, and partly by voluntary subscriptions. Under this system most of the schools of design are in debt, and the progress of them is rendered doubtful and disheartening."

"The Town Council of Bradford, Yorkshire, a most important manufacturing centre, as yet without a School of Design, have invited a deputation of the Committee to attend a public meeting there, on Monday the 2nd of February, that the inhabitants of the borough, and persons engaged in the staple manufactures of the district of the West Riding may have an opportunity of hearing and considering the views and explanatory statements of the Council."

At the meeting which was held as above, the following resolution was carried unanimously:—"That the meeting fully recognises the great advantages derivable from a self-supporting Institution, calculated to improve the art applied to the manufactures of Bradford and its neighbourhood, and the general taste of all classes, and especially of an elementary drawing and modelling school as an integral part of it, and, in conjunction with the Council of the Society of Arts, will take vigorous measures for giving effect to the same."

A deputation also visited Halifax, where a similar resolution was passed. But the Society did not pursue this portion of its proposed action, as the Government at once proceeded to re-constitute the Schools of Design throughout the country; and I merely refer to the matter for the purpose of showing that the Society of Arts did not overlook, but was prepared to take active measures for promoting and improving, the application of the art of design to industry. About the same period the Society received and circulated the details of a plan proposed by Mr. Thomas Twining, for the technical training of our artizans, in which he referred to the various important and successful establishments in Berlin, Paris, Chalons, Angers, Aix, &c., observing "that the plan he had adopted in arranging his remarks is that which seemed most likely to render them convenient to those who might be desirous of giving a full consideration to the subject of a National College of Trade."

The Society subsequently co-operated with the Royal Commissioners of the Exhibition of 1851, in forming a Trade Museum of Animal Products, which collection is now deposited in the Museum at South Kensington.

I have stated that the Council selected from among the many propositions suggested, and pressed upon its consideration, that by Mr. Harry Chester—as affording the broadest basis for effecting the universally desired amelioration of the educational condition of the artizan and working classes. The soundness of judgment which dictated that selection, has since been abundantly evidenced, but, in order to give point and value to the educational classes in Institutions, it was necessary not only to induce the establishment of classes, but also to give a motive to continuous study in them. This the Society effected, and is still effecting, by the systems of Examinations it instituted—the prizes it offered—the Government nominations it obtained for pupils who received certificates, and their efforts were greatly strengthened by the prize which the Prince Consort offered, and which has since been continued by Her Majesty, and awarded to the student who obtains the largest number of first-class certificates and prizes during four consecutive years. This work of education and examination it has been and still is pursuing. During the ten years of its progress it has published many papers on education, and an important report on the question of Industrial Instruction. In that report, which was first published in April, 1853, and again re-issued in May, 1857, it is stated that the Council resolved "to appoint a Committee to take into consideration, and report, how far, and in what manner, the Society of Arts may aid in the promotion of such an education of the people as shall lead to a more general and systematic cultivation of Arts, Manufactures, and Commerce—the chartered objects of the Society;" and the Committee in

its report stated "that it would be absurd, for example, to suppose that any school could turn out a ready-formed machine maker; yet the labour of the mechanical engineer, in giving practical instruction to his apprentice, would be not only lightened but made more efficient, if the latter had been previously taught mechanical drawing—had learned the properties of the lever, the pulley, and the wedge, and knew the nature of and difference between cast-iron, wrought-iron, and steel; while, therefore, the practical training would be left as heretofore, it cannot be denied that a knowledge of the principles of the sciences on which arts or trades are founded is an indispensable element in the intsruction of the well-skilled workman. * * * Innumerable rewards exist at present for the cultivation of classical learning—why should there not be some for the promotion of industrial knowledge?"

Notwithstanding all the efforts made, a system of industrial instruction still remains to be carried out, but the Council nevertheless considered that such had been the industrial and art progress made in this country that they were justified in proposing and succeeded in obtaining the support of the country for a second International Exhibition, viz., that of 1862. The Exhibition of 1862 was a display of Art and Industry of which England may well be proud. It resulted in placing British ingenuity and mechanical skill in a far higher position than it had ever previously attained to; its artistic powers had also increased, but the want of technical and scientific instruction was and is still felt as a necessity which must be met if British manufacturers and artizans are to hold a successful rivalry with their continental competitors in industries. The Society of Arts has accordingly again stepped forward to assist the artist workman, and by availing itself of the aids of the new and daily improving arts of chromo-lithography and photography, and also of metal casting, it has been enabled to institute a new series of competitive exhibitions for the Artist-Workman, at which exhibitions it has awarded prizes for the best productions in metal work, ivory carvings, China paintings, wood carving, &c., &c., thus recognising the skill of the workman and placing him in the foremost rank of executive producers, and doing for him that which the International Exhibitions have done for the capitalist and manufacturer, and what examinations have done for superior intelligence in reference to primary education.

I have now sufficiently indicated, not only what the Society has done, but is doing, and it remains for me to point out in my concluding remarks what it has not done and how it may possibly carry on to completion the great work upon which it has been engaged, and to which its labours have been pointing for so many years past, I mean the institution, in connection with the Society of Arts and other bodies, of lectures and classes, conducted by Professors, by means of which instruction in Art and Science, as it bears upon industry, may be given to our future workmen, as well as to those who may hereafter become masters, manufacturers, and the employers of skilled labour.

In order to effect so important an object, and gaining experience by what the Society has done with reference to the education of the artizan, I have naturally been led to consider what are the existing institutions of the country which might be appealed to to aid in so important a work; and in reviewing what the Society of Arts has done and is doing at the present time, I have been much impressed with the importance of developing, to as large an extent as possible, the system of co-operation with the trade guilds and companies existing in the City of London. For several years past the Society has been co-operating with the Company of Painter Stainers, which has held exhibitions in its hall and awarded prizes, to which the Society in the first instance contributed with a view to promote skilled labour in the various departments of their special industry. It last year gave aid to the Society of Wood carvers

At the present moment it is, jointly with the Company of Coach and Coach Harness-makers, affording its patronage to the workmen engaged in that trade who are about to hold an exhibition of the products of their skill and industry. Out of London it has contributed to a prize fund for the promotion of improved design and increased skill and ingenuity on the part of the Whitby jet-workers; and the question at once arises, would it be possible to induce a combined action on the part of the 80 City companies, the Chambers of Commerce, and other bodies in aid of the industrial education of the youths of the present day, as well as to encourage the skilled workman by the offer and award of prizes in each of their respective industries.

The Society of Arts has already begun the work, both by awarding prizes to skilled workmen and the institution of lectures on the application of science to industry; it will doubtless continue and extend its action in both directions; but to attain real instruction in science, more than lectures are necessary. Classes under competent Professors must be formed, if industries are to be benefited. At the close of the Great Exhibition of 1851, in order to attain more education in technical knowledge, it was said that the effort should be made to educate downwards—to give less classical and more practical education. The Society did not accept that proposition, but, beginning with the working classes, has been endeavouring to educate them upward; and now that its examinations have enabled their education to be tested and the fitness of youths to be advanced into classes where they may acquire precise knowledge as affecting industries, one of the difficulties in the way of the establishment of classes for industrial instruction is got rid of. The certificates of our own examiners, of those awarded at the Oxford Middle Class Examinations, which arose out of our own action, of the London University and others, should be the passport to our industrial classes.

If, then, the City Companies could be induced to co-operate with the Society of Arts in establishing a system of instruction and a test of the degree of knowledge acquired by those who are apprenticed by their corporations; if they would assist and co-operate with the Society of Arts, by offering and awarding prizes to the skilled workman, the Society might again create for the benefit of the public, Annual Displays and Exhibitions of the Products of British Industry, to which British manufacturers might send selections from their yearly commercial products, not advertising specimens got up for great exhibitions regardless of cost; the patented and mechanical inventions of each year might also be added, as well as samples of raw produce and imports, or selections from them. To effect the latter object it might be necessary to urge upon government the propriety of its doing for commerce what it already does for literature, by compelling the deposit in our national library of a copy of each work produced for sale; in like manner it might compel the deposit, when required, of samples of new imports.

Thus we should have an aggregation of the products of Arts, Manufactures, and Commerce, from which to select specimens for a National Trade Museum, which would again form the basis for a continued course of industrial instruction.

But it may be said, even admitting the desirability of the proposition, how can the Society of Arts, which is already limited in its powers of action by the want of space, provide the necessary accommodation for so extended a sphere of action? My answer is, the founders of the Society of Arts, believing that the institution of the Society and the promotion of the objects for which it was founded, would be a national benefit, appealed to the public for funds for the erection of the premises in which its business is at present conducted, and obtained them. The Society of Arts in our own day, believing that the International Exhibitions of 1851 and 1862 would be a public advantage, appealed to the public for the necessary funds and obtained them; and, believing in the national importance of the work in which the Society of Arts is at present engaged,

I have no doubt that the members of the Society and the public would respond to an appeal for funds if a comprehensive scheme supported by the co-operation of the City Companies and others, were placed before it. I also believe that the Society, which has an equitable claim to a portion of the surplus profits arising out of the Great Exhibition of 1851, a claim which it has never yet pressed upon the Government and the Royal Commissioners, might fairly advance such claim now the country has become possessed of a large portion of the estate purchased with that surplus and handed over to the government, as has been publicly stated at a price far below its market value.

Let the Society of Arts proceed then in its onward course, let it act the part of broker or middleman with energy; it knows what is the demand on the part of the public; it also knows how to obtain a supply to meet the demand. To hesitate or delay action, is to fail in its duty; to supply the demand is to add new honours to those it has so deservedly won during the century and upwards of its existence.

Prizes to Art-Workmen.—It would ill become me, as an officer of this Society, to criticise or express any opinion upon the various articles which have this year been received in competition for the Prizes offered to Art-Workmen; that is one of the duties which will be discharged by a Committee appointed by the Council; nor is it necessary that I should enter into any lengthened statement relative to the course which the Society has adopted relative to the offer of those prizes. Invited in the first instance, to co-operate with the Company of Painters Stainers for the offer and award of Prizes in promotion of their special industry, it was natural that other bodies, seeing the success which attended the efforts of that Company, should desire to apply a like stimulus to their own trades.

Accordingly, we find the Society of Wood Carvers applying to the Society of Arts to co-operate with that body in the offer and award of Prizes for the promotion of their special Art industry, and the Exhibition of Wood Carving, held in June, 1863, was the result.

The Council of the Society of Arts, seeing that there was a growing desire on the part of the Art-workmen to come forward and compete for honours in their several handicrafts, appointed a Committee, in March, 1863, "to consider and report what prizes the Society should offer for the encouragement of Art-workmanship applicable to manufactures," and, upon the recommendation of that Committee, the Council decided to offer prizes for the successful rendering of designs in the undermentioned processes of manufacture, according to the directions detailed in each case.

1. Modelling in terra cotta, plaster, and wax.
2. Repoussé work in any metal.
3. Hammered work in iron, brass, or copper.
4. Carving in ivory.
5. Chasing in metal.
6. Enamel painting on metal, copper, and gold.
7. Painting on porcelain.
8. Inlays in wood (marquetry or buhl), ivory, or metal.
9. Engraving on glass.
10. Embroidery.

The designs will be by artists of great reputation, to be translated into the various modes of workmanship; and photographs and castings of such designs will be sold by the Society, at the Society's House, at cost price, to persons desiring to be competitors."

In accordance with the above recommendation, a list of prizes was prepared and issued in May, 1863, and in October of the same year 72 works were received in competition. The works received were exhibited in the Society's room; and a list of the prizes awarded will be found in the *Journal* (See Vol. 12, page 75).

The success of this the Society's first effort, in connection with general Art industry, was so far satisfactory as to induce the Council to prepare a second list of subjects, the response to which will this evening be seen and judged of by the members.

I cannot conclude these remarks without congratulating the Society upon the continuous and steady growth of a desire on the part of the industrial classes to come forward and exhibit specimens of their skill and industry—a desire which has been abundantly evidenced by the Exhibitions held in South Lambeth last year, and more recently in the North of London. Other exhibitions of a like character are announced as about to be held in Marylebone, in Lambeth, and also by the workmen employed in the coach-making trade.

In connection with the latter Exhibition the Society of Arts has offered some special prizes, which will be competed for in February next. A list of these prizes is given below. The Exhibition will take place in the hall of the Company of Coach and Harness-makers.

Operative Coachmakers' Industrial Exhibition.—Special Prizes.

The Committee have great pleasure in submitting the following as a list of the Special Prizes promised up to the present time:—

The Society of Arts offers a prize of £10 together with the Society's Silver Medal, for the Best Set of Working Drawings for a Private Carriage, showing the construction of its various parts. Scale 1 inch to the foot.

Also £5 for the Best Specimens of Heraldic or Ornamental Chasing in Silver, Brass, or Copper, suitable for Carriage or Harness.

Also £5 for the Best Specimens of Heraldic or other Metal Ornaments produced by Electro deposit, suitable for Carriage or Harness Ornamentation.

The Worshipful Company of Coach and Coach Harness Makers place three Bronze Medals at the disposal of the Judges.

Also the Master of the Company (Thomas How, Esq.) offers £5 for the Best Design of an Open and Close Carriage combined. Scale 1 inch to the foot.

Mr. G. N. Hooper offers Three Guineas for the Best Drawing of a Town Barouche, on under and C Springs. Scale 1 inch to the foot. Open to foremen, carriage operatives, and apprentices.

Also Two Guineas for the Best Drawing or Model of a Light Hospital Carriage, to convey the sick poor. Open to all comers.

Mr. G. A. Thrupp offers Two Guineas for the Best Stuffed and Quilted Carriage Cushion in blue Morocco leather. Open to coach trimmers only.

Also Two Guineas for the Best Drawing in Pencil, upon Paper (half the full size) of an Under Fore-carriage for Elliptic Springs, of usual or original design. Open to apprentices and improvers.

Mr. J. F. Woodall offers Two Guineas for the Best Specimen Panel of Carriage Painting, eight Plain or Ornamental.

Also Two Guineas for the Best Finished Pad and Bridle, for Pair-horse Harness. Open only to harness makers working in carriage factories.

Also One Guinea for the Best Covered Carriage Dash-Iron sewed by hand.

Mr. Barlow offers Three Guineas for the Best Working Drawing (full size) of Ornamental State Lamp, of New Design, suitable for a Coach for Chariot.

Also Two Guineas for the Best Full-size Model of Brougham or Barouche Lamp, of New Design, uniting perfect ventillation and reflecting powers, to burn candle, oil, or other material.

Also Two Guineas for the Best Complete Set of Full-size Working Models of Furniture for Pair-horse Harness, of New Design. (Chased work not to be introduced.)

Or One Guinea for the Best Complete Set of Full-size Working Drawings of Furniture for Pair-horse Harness, of New Design. (Chased work not to be introduced.)

Also Half a Guinea for the Best Six Full-sized Models

or Twelve Full-size Working Drawings of Bridle Fronts, of New Design. (Chased work dot to be introduced.)

Also Half a Guinea for the Best Six Full-sized Working Drawings of Bridle Rosettes, of New Design, Chased or otherwise, from $2\frac{1}{4}$ to $2\frac{1}{2}$ inch diameter.

Also One Guinea for the Best Six Full-size Models or Twelve Full-size Working Drawings of Carriage Door Handles, of New Design. (No chased work to be introduced.)

Also Half a Guinea fer tho Best Specimen of Hard Solder Plating (silver or brass).

Also Half a Guinea for the Best Specimen of Soft Solder Plating (silver or brass).

The Committee offers—

For the Best Set of Working Drawings of Improved Street Cabs.

For the Best Specimen of Heraldic Painting.

For the Best Specimen of Decorative Coach-carving.

For the Best Set of Working Drawings for an improved Under Fore-Carriage for a Brougham, combining lightness and strength.

For the Best Specimen of Ornamental Carriage Painting, Imitation Pedestal Painting, Sham Caning; also for harmonious combination of Colours and perfection of surface.

For Parts of Harness, Improved, of Full-size or in Model-size, or the Best Design of improved Harness.

For the Best Covered Carriage Dasher, or Wing, or Seat Border, sewed by hand or machine.

For the Best Method os Detaching Fallen Horses quickly, either in front or rear.

For the Best Cushion, Stuffed and Quilted in any Material.

For the Best Design for New Mode of Trimming a Carriage Door.

For the Best Design for a Hammercloth, combining good effect and economy in cost.

DISCUSSION.

The Chairman said it was now his duty to invite discussion on the paper they had just heard read. The attendance this evening, and the manner in which the paper had been received, convinced him that the members appreciated, as he did, the great zeal and ability with which Mr. Davenport discharged his duties as an officer of the Society. He could not refrain from paying this tribute to him on an occasion when no doubt a great many of his personal friends were present. On previous occasions he had expressed himself with regard to the good fortune of this Society in being represented by three officers, all of whom possessed considerable talent, and who not only exercised their talent for the advancement of the best interests of the Society and the objects for which it was established, but who also contributed, by unity of purpose and action, in a most remarkable degree to the advancement of all those great objects for which the Society was established. He hoped the discussion would show that the members appreciated those services, and that the action of the Council for the last ten or fifteen years, in endeavouring to reform the education of the middle classes and of the Art-workman, was in harmony with the requirements of the times, and would meet with the hearty support and co-operation of the members at large.

Mr. H. Cole, C.B., remarked that there was one paragraph in Mr. Davenport's paper with which he could not agree. That was with regard to the Government compelling the deposit in some national museum of a copy of each manufactured work produced for sale. He thought Mr. Davenport was mistaken in supposing that Government could compel people to make such a deposit. For his own part he should be sorry to see any such compulsory law as that hinted at. Indeed, he thought it was not creditable in the present day that there should be a law compelling authors to deposit gratuitously copies of their works in the library of the British Museum and other public institutions. It was not an agreeable thing for a public officer, in the exercise of his duties, to be constantly summoning publishers to the police-court for not conforming to the law in this respect. He believed it was detrimental to literature, and he conceived it would be so to manufactures; and further, he felt certain that to build a huge Babel to hold specimens of the character named—good, bad, and indifferent, as the case might be—would be the most tiresome and uninteresting to visitors. He would now turn to the Exhibition arranged for inspection to night, and he must congratulate the competitors upon it. Although he had been unable to do more than take a cursory view of the objects, he felt assured that a considerable advance had been made in the quality of the work over that of last year. He had no doubt this idea of inducing artist-workmen to exhibit specimens of their handicraft would fructify. It would go on increasing, as was the case with the Royal Academy, which more than a century ago had started from small beginnings. In the outset of such a work as this, however, no doubt there would be some errors in detail which might require amendment, more especially as to the conditions attaching to some of the prizes offered. He feared that these conditions in some instances had perhaps prevented the sending in of so many specimens as might have been expected. For instance, a dozen casts of the bust of Clytie had been sold to workmen, but one only had been finished and sent in. This led him to fear that there was some condition connected with that matter which impeded competition. It might be that the bronze was not delivered in time for the work to be done in the workman's overtime, for it should be remembered that these things were executed in the workmen's overtime. He hoped the same bust would be competed for next year, so that the labour of those who had bought the cast this year might not be thrown away. Then again it might be considered that the works which the Council had put forth to be done were not such as when finished would be saleable commercial articles. That was no doubt partially true, though in their selection the Council had endeavoured to bear that principle in mind. He thought, however, he saw among the articles exhibited some which might properly be bought for the South Kensington Museum, and he hoped the Lord President would take that view. As an individual member of the Society, it occurred to him whether, in the selection of objects to be presented for execution in their next programme, it would not be well to take the workmen themselves into consultation, and ascertain which they would suggest as most fitted for the purpose; and he also thought the object might be still further promoted by a little co-operation on the part of those who were interested in special manufactures. He thought the Council would do well to receive suggestions from those quarters as to the subjects to be selected for competition. He would only further remark, that though some of these articles now exhibited might not be immediately saleable, yet he believed in many instances they would be the means of producing commissions for the producers of such articles. He might state that at South Kensington wood carvings were wanted, and he saw specimens this evening which led him to think that the persons who executed them might be called on to do something for that national establishment. He was gratified at seeing indications of a new branch of industry springing up, viz., glass mosaics. The heads exhibited this evening were the first publicly exhibited specimens of glass mosaics by English artizans he had ever seen. He considered these worthy of great attention, as he was satisfied before many years there would be a very extensive application of glass mosaics for decorative purposes. He had reason to believe that more than one of these specimens had been produced by females. It was a branch of industry in which that sex might be well employed, and he would only throw out the hint to those who might hereafter de-

sire to engage in it, that, as an indispensable preliminary, they should possess a sound knowledge and power of drawing.

Mr. D. Roberton Blaine had listened with great pleasure to the admirable paper; and his single objection to what had been advanced in it was confined to that part which had been alluded to by Mr. Cole, the compulsory deposit of specimens of manufactures at the expense of the manufacturers themselves.

The Chairman, quoting the passage of the paper referred to, said the suggestion only applied to "new imports" of raw materials employed in manufactures.

Mr. Blaine said the suggestion was an admirable one, if it were done at the expense of the Government; otherwise he took exception to it. In the case of the precedent that had been quoted, viz., on the compulsory deposit of copies of literary works in public libraries, he knew it operated in many cases as a great hardship upon authors and publishers, especially in the case of the more expensive works. If they wanted copies of works to be deposited, he thought the Government and the universities ought to pay for them. With regard to the many beautiful works which they saw before them, they afforded illustrations of the rapid advance which was making in Art-workmanship in this country. He referred with great satisfaction to the testimony borne by the French artisans who visited the Great Exhibition to the great progress made in this branch of industry by the workmen of this country. That was one great proof of the benefits of international exhibitions. The French people were now pressing upon their government the importance of following the example of this country in promoting schools of art, because they saw the wonderful progress which had been made in England since the Government Schools of Art had been established.

Mr. Peter Graham, referring to the selection of the special objects for execution, remarked that he regarded this as a necessary step, in the first instance, as serving for a guide to the competitors as to the class of works on which their skill should be exercised. On future occasions he thought more scope might be allowed, and that workmen might be permitted to bring their original works as proofs of talent in design, as well as power of execution. It was due to Mr. Davenport to thank him for several excellent suggestions he had thrown out in his paper. It would be a most desirable thing to obtain the co-operation of the wealthy City companies and guilds; take, for instance, the Goldsmiths' Company, he thought it was rather a reproach to that important company that it had not come forward to encourage by prizes the development of those beautiful arts with which it was identified. It possessed immense wealth, and he did not know how it could promote the interests of the guild, or do anything more creditable than to offer prizes in every branch of the goldsmith's art. The same remarks applied to other companies. One of the poorest and most obscure of those guilds, the Painters Stainers, had been the first to set an example in this direction. He had not yet minutely examined the collection of objects before them, but he could see at a glance that there was a great advance upon the display of last year; and no doubt if it was carried on in a right spirit they would see improvement year by year, till the art workmen of England were equal in execution to those of any other country in the world.

Mr. Winkworth said that he thought his friends Mr. Cole and Mr. Blaine had occupied too much time in discussing a point which was not important to the immediate object of the paper, and respecting which they had not quite apprehended Mr. Davenport's precise meaning. He had not, as they supposed, approved the policy, amounting to confiscation, of compelling authors to deposit copies of their works at the British Museum, the Universities, and other public institutions; but, assuming that it was to continue a law of the land, might it not be usefully extended, in the way suggested in his paper, to the promotion of Art-Manufacture education? He (Mr. Winkworth) also doubted whether, as the articles in and around the room which had attracted so much attention—and to some extent admiration also—were sent in competition for prizes, it was judicious or fair to anticipate the awards of the adjudicators hereafter to be appointed, by specially noticing certain specimens of art in the room which, in the opinion of the speaker, Mr. Blaine, were beautifully designed and executed. He would now recall the attention of the Society to the paper which had so much interested them, and justly so. Mr. Davenport had favoured them with a well-digested historical epitome of the action of the Society in the direction of industrial education, and in so doing could not fail to pay a tribute of recognition to the services Mr. Harry Chester had rendered to the cause of adult education in all its branches, by suggesting and initiating a system of competition which had borne most gratifying fruit, and the benefits of which were being daily extended. That which he had organised might be introduced into a sphere of education which should give to the artisan a kind of technical knowledge, of which English workmen were for the most part ignorant or were only partially acquainted. He had in his paper suggested several new directions, as, for instance, lectures and classes, conducted by professors, by which instruction in art and science, so far as they bore on skilled industry, might be properly communicated; and one original way in which this might be encouraged, the action of the trade guilds and companies, might be invoked, as in the case of the Painters Stainers' Company and others. To this he (Mr. Winkworth) cordially assented, but Mr. Davenport should not indulge the hope that the suggestion would meet with universal acquiescence, for it must not be forgotten that many of these corporations had outlived the trades for the promotion of which they were ostensibly established. Who, for instance, could tell them what was the particular craft originally contemplated by the Loriners' Company? Others, again, as the Fishmongers' and Spectacle-makers,' did not seem to afford scope for the offer of prizes for new discoveries or appliances in their particular branches of trade. The bulk of the members of many of the City companies had in fact no idea of the crafts they were apprenticed to learn, and the secrets of which they were sworn not to divulge. Others again had no funds that could be legally diverted to objects external to their own. But, on the other hand, the City companies were in the aggregate wealthy and patriotic; and whether their own specialities afforded scope or not for the offer of prizes to elicit talent in the cultivation of them, they would no doubt, if suitably approached, be found willing to contribute of their abundance towards objects so legitimate and praiseworthy as Mr. Davenport in his paper had so luminously pointed out. He had only in conclusion to repeat that he felt much indebted to Mr. Davenport for his well-arranged and well-digested paper on topics at this moment so generally interesting, and he confidently anticipated that the result of the discussion would be to affirm the propositions he had submitted, and to suggest means for carrying them out.

Mr. George Godwin, F.R.S., could not allow the last observation to pass without comment, as he confessed he did not take the same satisfactory view of the objects exhibited which the hon. gentleman who preceded him had done. That it was much better than the collection on the previous occasion there could be no question, but that it came up to the inducements held out by the Council of the Society he was unable to say. Premiums to the extent of nearly £600 were offered by the Society for objects in all these branches of art industry, and though there were many excellent works in the collection, he was afraid when the majority came to be critically examined, a small portion only would be found entitled to high commendation. The inference to be drawn was that there was something more to be done than the mere offering of prizes. They had to labour to induce a greater appreciation of the necessity of education. Looking at the means

now afforded to working men and to those above them, it seemed to him discreditable that the response to the invitation had not been greater. During the last few months he had been frequently called upon by old workmen, journeymen carpenters, bricklayers, and plasterers, for advice as to what they could do for their sons, in order to get them out of the fixed drudgery in which they themselves had been compelled to labour for so many years. His simple advice was, and he wished the hint might find its way into the workshops of this country, let them learn drawing. There were schools of design throughout the metropolis, and in nearly every large town. If it was necessary, the parents must make a little sacrifice to enable their children to do this. In so doing they would make their children to rise above their own position. Their course was easy; schools of design were plentiful; competitions were open; there were the examinations and prizes of the Society of Arts; and there was a wide field open for the development of the fine arts for decorative purposes, domestic and ecclesiastical. The moment a man showed ability he was sure to be taken by the hand, and to raise himself a step beyond the position in which his father was toiling. They wanted in addition, however, some little effort on the part of manufacturers and from the large builders. He thought the system of apprenticeship had been too much neglected. It should be urged upon the large builders and others that they should aid their men in pushing forward their sons; that they should take the sons into their establishments, and enable them to gain a superior position in their trade. It was a lamentable fact, that notwithstanding what had been already done, the great body of artisans of the present day were universally inferior to the artisans of 70 years ago. They could not get the same number of good bricklayers, or an equal number of carpenters with the same amount of geometrical knowledge as formerly. The system of contract work had led to a demand for quantity rather than quality. The absorption of various trades into one person's hands, in the shape of contractors, had destroyed emulation, and stood in the way of the small masters. As an instance he referred to the fine plastering which was to be seen in some of the older houses in London. There were not men now to be found to do this work. It therefore behoved this Society to go on in its course of stimulating the education of the artisan. At the late Exhibition of the Architectural Museum, only five specimens were sent in for competition for prizes, varying from £5, £10, to £20, and none of these possessed sufficient merit to induce the Council to award the prizes offered. That showed how small the response had been there; and it was small on the present occasion, taking into consideration the large sum offered in premiums by the Society of Arts. The notion had been entertained by himself and others that it would be well to invite the skilled artisans of London to a conference in this room, in order that they might state why they had not competed more largely, and under what circumstances they would compete? Such a proceeding would put them in possession of facts which would enable them to obtain larger results. What was sought for by these competitions was the encouragement of a more intimate union between the fine arts and the useful—the wedding of Venus and Vulcan. Speaking of the latter, he was sorry to note how small was the response as regarded hammered iron and brass work. It was ridiculous that there should be only two or three small specimens of this description of work sent in in response to the appeal that had been made. He was sure all present would thank Mr. Davenport for his paper. He was not certain that they could look to the great City companies for more than pecuniary aid; but the competitors would require to be assured from the beginning that those who were to be the judges of their work had some practical acquaintance with it. Companies were not qualified themselves to be the adjudicators of the prizes, because the workmen would not have confidence in their judgment. With regard to lectures, they were important and no doubt valuable, but they would not alone make good artisans or good workmen. There must be actual practice in the studio and the workshop.

Mr. B. Waterhouse Hawkins would venture to support the suggestion made by Mr. Cole and repeated by Mr. Graham, viz., giving a little more liberty in the conditions of the competition, to the extent that while certain photographs and models might be selected as the type of the work to be performed, the workmen should be at liberty to enlarge upon the original design, that it might be employed in the decoration of some article of utility, so that the person who succeeded in that direction might find his reward in having produced an article, which in itself would be saleable, and not a mere abstract work of art. In the production of these works, it must be remembered that the artisan occupied his time after the ordinary hours of labour, and hence he thought the time allowed was scarcely sufficient. The greater part of the work could only be performed during the evenings in summer time. He was inclined to think that by giving a longer time they would have a larger collection of works sent in.

Mr. Thomas Jones, with reference to the co-operation of the City companies, remarked that so far from the Goldsmiths' Company assisting in the production of works of art, their practice in testing the purity of the metal employed, and sent to them for that purpose, did much injury to them. Works of excellent truthfulness and perfection of form sent there to receive the certificate of the company that the material was of a given standard, were, from the manner in which they were treated, unnecessarily disfigured, and rendered unfit for sale until they had a second time passed through the hands of the workman. It would be a great benefit if this Society could become the means of inducing that distinguished company to treat the works of art confided to them a little more carefully. It had been stated that the Painters Stainer's Company had been the first in the movement of promoting competition of the character under discussion this evening. He, however, believed it was the Loriners' Company to which that honour belonged. Unfortunately, however, the effort was discontinued, in consequence of a feeling on the part of some of the members of that guild that the funds ought not to be diverted to the rewarding of persons outside their own pale.

Mr. P. L. Simmonds cordially approved of the suggestion of Mr. Davenport, that raw materials of commerce should be deposited with the Society, for the purposes of scientific examination and report. There was at present no convenient public place of deposit where such articles could be seen and examined. He knew many new oil-seeds, fibres, gums, paper materials, &c., were received by brokers and merchants in this great commercial port from time to time, which were either entirely overlooked or but little appreciated, and yet many of these might become most important for manufacturing use. Mr. T. C. Archer had a few years ago read a paper before the Society "On some New Articles which had come into Commerce in the Port of Liverpool," but they scarcely ever heard of the new articles which were received in London. The Society had already been the means of introducing to public notice many valuable articles of commerce, such as gutta-percha and Balata gums, Indian silks, new oils, &c., and could do much more good if specimens were deposited for examination by importers and others.

Mr. Philip Palmer said the object of the co-operation of the City companies had been introduced by him at the first meeting of the session. He would follow up what he then said by adding, that in the observations he submitted, he did not mean that companies should institute separate competitions or separate exhibitions, but that they should render their assistance to the competitions of this Society. In this respect he apprehended there would be no great difficulty in obtaining the co-operation of such

companies; for instance, the Mercers' Company might contribute prizes in connection with textile fabrics. The Grocers' Company might render their assistance in the matter of colonial productions, as suggested by the observations of the last speaker. The spectacle-makers' operations might, he apprehended, be extended to the whole range of optical instruments. He agreed with Mr. Godwin that it would be a great advantage to all branches of trade that a proper apprenticeship-system should be established.

Mr. Joseph Ash stated his belief that the small exhibition in wood carvings at the Architectural Museum, alluded to by Mr. Godwin, arose from the almost entire absence of practical working men in the Council of that Institution, who acted as the adjudicators of the prizes. He thought it of the utmost importance that the competitors in such competitions as these should have confidence that the merits of their works would be decided by a competent tribunal of practical men.

Mr. George Lock claimed to be the originator of the scheme for prizes in wood-carving which had called forth the present competition in that department; and he begged permission to say a few words on points which had been suggested by this and the preceding display. He agreed with the last speaker, that the paucity of specimens at the Exhibition of the Architectural Museum was in a great measure due to the cause which had just been pointed out; and he suggested that in these exhibitions it should be a condition, that the jurors appointed to decide on the merits of the competitors should include a fair proportion of practical men in each branch of the subjects. He felt if that was not done these competitions would suffer. With respect to the subjects selected by the Council for the wood carvings, he believed there was no cause for complaint, inasmuch as in addition to the models and photographs issued, there was in the programme this year a series of prizes offered for original works in wood carving, no design or model being prescribed. Complaint had been made on the part of a few employers, who were not themselves Art workmen, with regard to the indefinite period for which the articles were required to be left in charge of the Society. Some tradesmen considered it an inconvenience to lose a portion of their stock for a lengthened period, and he thought it a matter worthy of consideration previous to the next competition. From some quarters he had heard complaints of want of proper information from the officers of the Society. He did not mention this as implying any neglect on the part of the officers, for he was quite aware of the vast amount of extra labour which these exhibitions entailed upon them. Another point he would suggest was a more extended publicity being given of these competitions; and with that view he suggested that they should be advertised in those newspapers which were mostly read by working men. The mere announcement in the Society's *Journal* was not sufficient, as that publication was not seen by working men. He had been told by one of the promoters of the North London Exhibition that not one of the fifty persons who acted with him had heard of this intended competition. He concurred in the suggestion that the competitors should to a certain extent be consulted as to the subjects which should be selected as models on which they should exercise their skill. Mr. Lock then alluded to the proceedings of the Society in respect of its competition of a similar character to this in the latter part of the preceding century, when the sculptors Banks, Nollekins, and Bacon were among those receiving rewards. The last-mentioned artist succeeded in carrying off several valuable prizes, and the advantage of the system to him in after-life was acknowledged in a letter to the then Council of the Society. In conclusion, Mr. Lock expressed a hope that the Council would consider the desirability of exhibiting ancient works of art in connection with this display of the articles sent in competition for prizes. He believed that such a course would give additional interest, and would be of great value to the competitors and Art-workmen generally.

Mr. H. Hale said one reason why the response on the part of the wood-carvers had not been more extensive was to be found in the fact that that class of workmen had been so much occupied by the pressure of business of their employers during the last year, that they had no leisure to prepare objects for this exhibition.

The Chairman said, the time having arrived for closing the discussion, he thought Mr. Davenport might congratulate himself on his paper having elicited one of the best and most useful discussions of the session. There were, however, one or two observations, especially those of Mr. Lock, which required some notice from him as Chairman of the Council. Mr. Lock had stated that complaints had been made in some quarters of the length of time the specimens were kept in the Society's charge, and that whilst such specimens were kept out of stock they might become unsaleable. Now, with regard to articles taken out of a tradesman's stock, if that were known to be the case they would not be admitted to competition, for it was not the object of the Society in these competitions that persons should compete who were able to keep works in stock, and employ others to do the work. The great object was to do for the Art workmen in his special handicraft that which had already been done in another direction in testing the knowledge of candidates by the examinations instituted by the Society. The Society sought to stimulate the Art workman by giving opportunities for testing his skill, and by placing before him models and photographs of the best examples in each branch of industrial art. With respect to the character of the subjects and the conditions of the competition, he might state that out of the 97 articles sent in, 34 were in connection with that division of the programme in which no restriction was laid down as to choice of subject, and for which no examples were prescribed. The competitors were free to do that which they thought best suited to their individual talents and powers. He could not help alluding to the beautiful carving of the head of a child behind him, in illustration of this statement. No model or photograph was furnished for that beautiful work. Having referred to some other works exhibited, the Chairman went on to remark upon the co-operation of the City companies in this work. He said it was a difficult but an interesting question. Taking the twelve leading companies in their order of seniority—the Mercers, Drapers, and Grocers—might be asked to offer prizes for the finest productions of the loom in all the branches of textile fabrics. Again, the Fishmongers' Company might be brought into the field. The most beautiful of old china was replete with forms of animals in all sorts of relief. That company might offer prizes for the best designs in earthenware or china exhibiting the best drawings of the denizens of the seas and rivers of this country. Of the Goldsmiths' Company he need say no more, now that it was to be hoped that instead of converting watch cases into cocked hats they would test the quality of the gold and allow the beautiful work of the lathe or the tool to be returned to the owner, uninjured, and offer prizes for the best specimens of chasing or of ornamental jewellery. The Vintners' Company again might, in like manner, do their share in this good work, and encourage the artistic embellishment of metal work, by offering prizes for ornamental designs, in which the beautiful stem, leaves, and tendrils of the vine might be most elegantly introduced, and with which many of the most beautiful ancient bronzes were ornamented. In this way something might be done by the great majority of the City companies, but it could only be effected by great attention and labour on the part of the Council, and whether they would have time to enter upon it during this year he could not at present say. It was a pleasant thing to the Council to hear a certain amount of fault found with these proceedings, and to have attention directed to any weak points in the system by so friendly yet so powerful a critic as Mr. Lock. He believed, however, they were in the main fulfilling the

wishes of the members in the course they had pursued with respect to these Art workman prizes; and when it was said that intending competitors could not gain the necessary information from the officers to enable them to send in their works in time, he was sorry that such a statement had been made, as he was convinced some misunderstanding must have occurred, for no workman could have applied to Mr. Foster or Mr. Davenport without obtaining the fullest information it was in the power of those gentlemen to give. Another observation required remark, viz., that relating to want of sufficient publicity being given to the rewards offered by the Society. He believed Mr. Lock did not know what had been done by the Council, who had distributed bills containing their programme very freely among the principal workshops; and to prove that the workmen were aware of the competition, he would state that nearly 600 copies of the photographs and engravings had been bought by the workmen at the Society's house; and further, with respect to the insufficiency of the time allowed, he would add that the notices were issued in February for works to be delivered here in the November following. Then, with respect to the time the articles were delivered, and the period which elapsed between the exhibition and the adjudication of the prizes last year, he must say that the works were not sent in till June, and they could not name a day for the distribution of the prizes until the Prince of Wales became the President, and appointed a day for that purpose; and he believed the recipients of the awards were more gratified at the honour of receiving them from the hands of his Royal Highness, than disappointed on account of the time they had to wait for them. On the point referred to by Mr. Godwin, who spoke from his own knowledge, which was very extensive, that the workmen of the present day were not equal in skill to those of seventy or eighty years ago, he thought that remark required some qualification. They might not be able to get plasterers to do the splendid work which they saw in some of the old city halls. It was a description of work not executed now, because the most beautiful forms of ornamentation were produced more quickly, and they could not afford the time for it. But if they tested the skill of the workmen as a whole—in the precious metals, in plate, in china painting, or the works of the loom, they knew that the French artists had expressed their surprise at the wonderful progress made in this country.

Mr. Godwin said the remark he had made applied merely to building operations.

The Chairman said that he would carry his remarks no further, but he would ask the meeting to thank Mr. Davenport for his very interesting paper, and to congratulate him on the interesting discussion which had followed the reading of that paper.

The vote of thanks having been passed,

Mr. Davenport in acknowledging the vote of thanks said in reply to the observations made by Mr. Cole and Mr. Blaine, that the idea which he intended to express was this—if Art, Manufactures, and Literature, are beneficially promoted by the protection which the government of the country gives to the author, the artist, the designer, the manufacturer, and the mechanic, by means of the Copyright Laws, the registration of Designs Act, and the Patent Laws, in each of which cases where a monopoly is granted, a copy of the design or specification of the article to be protected, is deposited for the information of the public in some duly appointed repository, might not the Government, with equal justice and advantage, be asked to give to the person who discovered in a foreign country products fitted for and applicable to industries, be enabled to obtain a right of import from such country of the product which he had discovered, and of which he was the first and the true importer; and in consideration of such right being granted he might be required to deposit samples of the product, which could be deposited in a National Trade Museum. He never for one moment contemplated the desirability or possibility of Government compelling manufacturers to deposit copies of the works they produced. In thanking the members for the full discussion which they had given his paper, he would add that his object in writing it would be fully attained if the interests which the Society was established to promote, could be advanced one step by the adoption of any of the suggestions made in the course of the discussion.

ROYAL SCOTTISH SOCIETY OF ARTS.

Forty-fourth Session. Third Meeting.

The Society met in their hall, 117, George-street, Edinburgh, on Monday, the 12th Dec., at 8 o'clock, p.m. Charles Cowan, Esq., of Logan-house, President of the Society, in the chair.

The following communication was made:—"Exposition of the late Researches on the Cohesion Figures of Liquids," by Thomas Thethill Wright, M.D., &c., with illustrations by the oxy-hydrogen light.

Dr. Wright stated that, on being requested to give one of the "Special Discourses to the Society of Arts," he had chosen the subject of the "Cohesion Figures of Fluids," as he was desirous of bringing before the practical men assembled at the meeting the remarkable researches of Tomlinson, as well as observations made by himself in the same field. The lecturer then proceeded to give a very full exposition of Tomlinson's discoveries, with numerous carefully executed drawings of the cohesion figures of various oils and other fluids when dropped upon surfaces of water and other liquids, figures which have already been exhibited by their discoverer at the Society of Arts in London in his paper read before it. Dr. Wright then proceeded to describe two new classes of cohesion figures discovered by himself:—1st. Figures produced on perfectly clear and freshly split surfaces of mica; and 2nd. Figures produced by drops of fluid on surfaces of mica or glass, when connected with the poles of an induction-coil. He showed, by the oxy-hydrogen lantern, on a screen twelve feet in diameter, images of both these classes of figures, as well as numerous drawings of microscopic figures which were too small to appear on the screen. The mica figures were produced by placing a large drop of fluid (sulphuric acid, nitric acid, tinctures of iodine, henbane, vegetable infusions, and a great variety of animal fluids and mixtures of them) on the surface of the mica, and gently breathing on them, when the cohesion figures instantly developed themselves in an infinite variety of forms. Those shown on the screen consisted of an infusion of the extracts of belladonna, senna, and hemlock, and of healthy urine, urine containing bile, and urine containing albumen. These figures were rendered visible, developed as it were, by dusting them with a powder-puff containing hair-powder or the finest lamp-black. Dr. Wright pointed out that all these figures presented a distinctly bisymmetrical form, and imitated, with remarkable clearness, the forms of various microscopic algæ and diatoms; while some of the images of urine, developed with carbon, in addition to their branching forms, were minutely veined, so as to resemble the finest specimens of agate. The second class of figures—the electric cohesion figures*—differed entirely with the fluid used, the surface on which it was placed (whether glass or mica), the intensity of the electric current, and the pole (whether positive or negative) by which the fluid was electrized. Very splendid and large figures were made on chemically

* In producing the electric cohesion figures, a plate of brass is laid on the table, and covered with a sheet of black paper dripping in a solution of chloride of calcium; on this the glass plate is laid, and in the centre of the glass plate the minute drop of fluid to be electrized. One pole of the induction coil is connected with the brass plate, the other with the drop. The figures instantly shoot out as soon as the induction coil break is set in motion.

clean plate-glass by powerful induction coils. But the greatest variety of figures occurred when the thinnest microscopic glass and mica were employed, with a small induction coil, giving a spark of about a tenth of an inch. The electric figures on mica differed entirely from those on glass; and those on mica freshly split from those on mica washed, heated, or exposed to the air; in fact, the slightest change in the character of the fluid, or the surface on which it was dropped, resulted in the production of difference of figures. The electric figures projected on the screen imitated curious forms and species of Ulva, Ceramium, Delesseria, and finely-branched lycopodiums. Dr. Wright stated that in these cohesive figures of Tomlinson and himself, the pattern-designer possessed a source of infinite diversity of form, free from the stiffness of the designs furnished by the kaleidoscope of Brewster. Many of the figures in mica glowed with all the gorgeous tints of the soap bubble.

At the close of the discourse, his grace the Duke of Argyll moved a special vote of thanks to Dr. Wright for his admirable exposition, which was seconded by Dr. Stevenson Macadam, and unanimously agreed to.

The Society then proceeded to private business.

DUBLIN INTERNATIONAL EXHIBITION, 1865.

It is eminently satisfactory to learn that this enterprise, undertaken by Irishmen, actuated solely by patriotic motives, will fully realise the hopes of its promoters. The preparatory arrangements are in a forward condition, and the promises of support from home contributors ensure the success of the Exhibition.

Continental exhibitors have come forward with alacrity, and from them large contributions are expected. From France there will be a magnificent collection of bronzes and goldsmiths' work, of silks and laces; it is even hinted that the *Gobelins* and *Sèvres* will not be unrepresented. Austria will send specimens of all those beautiful manufactures which attracted so much attention in 1862. Italy intends to surpass herself; filigree work from Genoa, ornamental metal work from Milan, mosaics from Florence, and cameos from Leghorn, will attest the renewed industrial activity of this rising country. A display of sculpture, equalling, if not surpassing, the attractive collection sent in 1862, is promised from Rome. The show of manufactures from Belgium will be in proportion to the extent of her important industries. Countries in the North of Europe will be chiefly represented by works of Fine Art, of these special details will be given hereafter.

One special feature of this Exhibition, not attempted on any former occasion, will be an international display of musical instruments. A large hall, specially designed for concerts, and capable of seating 3,000 persons, has been devoted to this purpose. In it the instruments of all nations will be collected, and daily performances will take place during the continuance of the Exhibition. Exhibitors will therefore have the advantage, not only of showing their works, but also of having them tested under most favourable circumstances, and music as an art will be added to the other attractions of the Exhibition.

The following foreign committees and agencies have already been nominated:—

Amsterdam.—*Commissioners*—Mons. C. E. Vaillant and Dr. J. A. Van Eyck.

Bern.—*Commissioner*—Professor Vogt.

Brussels.—*Committee*—M. Fortamps, Senator; M. Corr Vander Maeren; and M. Jules Kindt, Industrial Inspector, &c. *Secretaries*—M. Dulieu; M. C. J. Clerfeyt, *Assistant*. Office, 30, Avenue de la Toison d'Or.

Christiania, Norway.—*Committee*—J. R. Crowe, Esq., C.B., Her Majesty's Consul, and M. E. Tidemand.

Constantinople.—Edward F. Ede, Esq.

Copenhagen.—Professor Hümmell.

Dusseldorf.—*Commissioners for Prussia*—Herr Alexander Von Sybel, Elizabeth Strasse; William Mulvany, Esq.; and M. Adolph Tidemand.

Florence.—*Committee*—Baron Ricasoli; Marchese Ginori; Cav. Cesare Conti, Pres. Chamber of Commerce; Cav. Niccoli Antinori, Sec. Academy of Fine Arts; Charles Lever, Esq., H.B.M. Consul for Spezzia. *Secretary*—Signor P. L. Barzelotti, Advocate. Office, Chamber of Commerce, Florence.

Frankfort-on-Maine.—*Commissioner*—Herr Peter Bender, Market-place.

Milan.—*Committee*—Cav. Antonio Caimi, Sec. Academy of Fine Arts; Comm. Giulio Curioni, Sec. Lombard Institute; and Cav. Carlo Pisani, Sec. Chamber of Commerce.

Nuremberg.—Dr. Beeg, Director of the Industrial Museum.

Paris.—*Commissioners*—M. Savoye, M. Cappe, and M. S. Ferguson, fils (special for Class C). *Secretary*—M. Tolhausen. Office, at the Palais de l'Industrie, Porte No. 1, Champs Elysées.

Rome.—*Commission.*—Baron Comm. Pier Domencio Constantini Baldini, Minister of Commerce, Fine Arts, and Public Works, *President*; Cav. Luigi Cosi, *Vice-President*; Comm. Luigi Grifi, Sec. Ministry of Commerce, &c., *Secretary*; Comm. Tommaso Minardi, Inspector of Public Pictures; Comm. P. Ercole Visconti, Commissary of Antiquities; Comm. Pietro Tenerani, Director of the Pontifical Museums and Galleries; Comm. Luigi Poletti; Cav. Francesco Podesti; Cav. Giovanni Batista de Rossi; Comm. Virginio Vespignani; Comm. Niccola Cavilieri S. Bertolo; Cav. Prof. Benedetto Viale Prelà; Prof. Francesco Pratti; Cav. Valerio Trocchi, President of the Chamber of Commerce; Prof. Clement Luigi Jacobini; and Cav. Prof. Giuseppe Ponzi.

Stockholm.—*Committee*—T. C. Hunt, Esq., H.B.M. Consul, and Count Rosen.

Turin.—*Committee*—Comm. Devincenzi, Royal Museum of Industry; Hon. H. G. Elliott, H.B.M. Ambassador; Professor Manna, formerly Minister of Agriculture, &c.; Comm. Matteuci, formerly Minister of Public Instruction; Cav. G. B. Tasca, President of the Chamber of Commerce; Cav. Pio Agodino; Cav. Luigi Rey; and G. P. Jervis, Esq., *Acting Secretary*. *Assistant*—Signor Antonio Fassini. Office, at the Royal Industrial Museum.

Vienna.—*Commissioner*—Herr Heinrich, Sec. Society of Arts, Tuchlauben, II.

INDUSTRIAL EXHIBITION FOR MARYLEBONE.

A meeting was held on the 13th Dec., at the Marylebone Court-house, Marylebone-street, for the purpose of getting up a Working Classes Industrial Exhibition in that populous and wealthy borough.

Sir Roundell Palmer, Attorney-General, who occupied the chair, observed they must all feel anxious that opportunities should be given to the promoters of industrial pursuits and the fine arts among the working men, to have their works presented before the public in a manner as advantageous as those of others, and perhaps more so, especially as they had now had resources, by means of these exhibitions, which ought to enable them to compete with advantage with any other class in this metropolis. The language held in a resolution passed on the 14th of September, declaring that exhibitions of this kind were eminently calculated to promote inventions and industrial arts, did great good, by rousing the public mind to their advantage. Exhibitions of this kind showed clearly what could be done even under great disadvantages. The credit of the works of the artisans, or working classes, had hitherto too frequently been given to the employers instead of the artisans themselves, and it was therefore exceedingly desirable to give the latter an opportunity of receiving the rewards due to their success. It was clear

that such industrial exhibitions promoted inventive arts, and ought therefore to be encouraged by every possible means. He had been told that some anxiety was felt because the exhibitors at these exhibitions had no tthe same protection afforded them for their inventions as was given at the great exhibitions. Now to afford that protection was a just principle. Whether there was at that moment any practical objection to such a course he could not take upon himself to say, but he would do the best in his power to remove that evil, and he should be prepared to give due and just protection to them, and in a manner by which they would be enabled to take out their patents as if no publication or exhibitions of this kind ever existed.

The Rev. Eardley Wilmot, one of a deputation from the Central Committee, said they lived in an age of progressive improvement in arts and sciences, and especially among the working classes; and he would remind them that one of the greatest improvements of the day—namely, the system of railways—was the invention of a labouring man, Mr. George Stephenson. As regarded the proposed Industrial Exhibition, there was no doubt whatever that, socially, morally, and artistically, it would be of great advantage to the working classes, whose ingenuity and industry were now used, generally speaking, for the advantage of employers. With respect to the movement itself, they had held already many district meetings, formed a general committee, and appointed a treasurer to receive subscriptions, in order to form a guarantee fund. They were in treaty for the Polytechnic Institution, and hoped by the end of next March to have an Exhibition open for a few months, which would be of the greatest possible advantage.

Mr. Morrell said no less than £244 was already subscribed by the working men themselves as a guarantee fund. As to a protection being given to exhibitors, their learned chairman told them he would do all in his power to obtain it; and they had already a similar promise from the Commissioner of Works. Such a protection was granted at the Great Exhibition, and he was sure Lord Palmerston would afford the same to the working classes.

Mr. Howe moved, and Mr. Morris seconded, the first resolution, "That this meeting cordially approves the proposed Industrial Exhibition for the working classes for the borough of Marylebone, and pledges itself to use every exertion to carry it out."

Mr. Graham would be glad to render every assistance in his power for the success of the Exhibition, and had great pleasure in supporting the resolution.

Mr. Hutton moved, and Mr. Pinner seconded, the next resolution:—"That a district committee, to be called the Court House Committee, be formed out of this meeting, who shall arrange their own place and time of meeting; and depute three of their members as representatives at the Central Committee, which meets every Friday evening at the Working Men's Club."

Mr. Nicholay supported the motion. He had taken an interest in other Exhibitions, and especially in that of North London, which was an eminent success in every particular, and realised, after paying all expenses, upwards of £1,000, which was now in the hands of the committee, and would be devoted to some useful public object.

Fine Arts.

Royal Academy.—At the recent examination of the Royal Academy silver medals were awarded to Mr. Thomas Davidson, for his painting from the life; to Mr. Frederick George Oakes, for the best copy in oil colours; to Mr. Claude Andrews Calthrop, for the best drawing from the life; to Mr. Richard Lincoln Alldridge, for the best drawing from the antique; to Mr. James Griffiths, for the best model from the antique: to Mr. Sydney Williams Lee, for the best architectural drawing; to Mr. Horace Henry Cauty, for the best perspective drawing; and to Mr. Richard Phené Spiers, the travelling studentship for one year, for architectural design. —On Friday evening, 16th December, at a general meeting of the Royal Academy, two associates were admitted to full honours to fill the places left vacant by Thomas Dyce and Sir Watson Gordon. The choice fell upon Mr. Thomas Faed and Mr. John Callcott Horsley. The vacancy by the death of David Roberts has not yet been filled up.—Mr. Solomon Hart, R.A., has been elected librarian of the Royal Academy, in the place of Mr. Pickersgill, R.A., resigned.

The Queen's New Cameos.—The Queen has commissioned Signor Saulini, of Rome, to execute a number of cameos in shell, representing the busts of her Majesty and the late Prince Albert. Some of these beautiful works, exquisite in conception and in art, have arrived in London, where they will be set in gold, and presented, it is said, as others have been, either to members of the Royal family or to distinguished ladies. personal friends of the Queen. One not uncommonly meets with German ladies who wear on the left shoulder decorations presented by their sovereign, and perhaps her Majesty in this touching way has instituted an order to perpetuate the memory of one in every manner so worthy of her deep affection. The likeness of Prince Albert is inside, that of the Queen outside, and both are admirable specimens of the artistic skill of Saulini. Already by command of her Majesty six cameos have been cut in pietra dura (onyx), four in shell, and five more in shell have yet to be completed. Those in the pietra dura require long and patient labour, each occupying from three to four months in completion.

Re-arrangement in the Louvre.—Those who have not visited Paris for a year or so will find many alterations. In the first place, there are the new galleries containing the works of the French School, the extensive Campana and Sauvageot collections, and the great Etruscan room, of which mention has already been made in the *Journal*. More recently two large apartments in the basement of the New Louvre have been opened to the public, one containing the statues and busts belonging to the Campana collection, which, however, are very unfortunately placed with respect to the light, the vaulting being low and flat, and both sides pierced with numerous windows. This great defect is not felt in the companion gallery, which is now occupied by the electro-galvanic reproductions of Trajan's column, which were referred to in a cursory manner in the report of a visit to the works of M. Oudry, at Auteuil, which appeared in the *Journal* some months since. The whole of these extraordinary reproductions may now be seen and examined conveniently. These beautiful casts have been set up in their proper spiral order on six sections of a column, each about twenty feet in height, with the exception of the four sides of the square basement which stand against the walls of the gallery; every portion is well exhibited, and the whole forms an admirable study. We understand that a complete and illustrated description is being prepared by command of the Emperor. The portion of the great picture gallery built by Louis XIV. is now completely demolished, and its reconstruction, in harmony with the beautiful work of Henry IV., is about to be commenced. Lastly, the administration is at the present moment considering the question, or rather trying the experiment, after the example of the Tribune of Florence, of introducing sculpture into the picture galleries. In the centre of the apartment known as the Salon Carré, the square room in which are placed the *chefs-d'œuvre* of the collection, has been placed the famous "Diane à la biche;" at the door which leads from this room into the great gallery are a

"Venus" and a "Bacchante;" and at the end of the small gallery, which contains a collection of the works of the Italian School, stands the "Diane de Gabics." There is no doubt that the effect of the statues is good, but the removal of such works causes a terrible blank in the sculpture gallery.

Manufactures.

Gamboge.—At a meeting of the Pharmaceutical Society, on December the 3rd, Mr. Daniel Hanbury read a paper "On the Botanical Origin of Gamboge," by which it appears that the exact botanical origin of gamboge has long been involved in obscurity, for though it was known to be a plant of the genus Garcinia, the species had never been determined. Hermann, who lived in Ceylon in the 17th century, referred the origin to two plants—one now known as *Garcinia Morella*, the other as *G. Cambogia*—and it is stated by Mr. Thwaites that the former yields a good form of the drug, but not the latter. Gamboge, however, is not an export from Ceylon, but is produced in Siam, a country as yet but little known to botanists. Whether gamboge was obtained from the same tree in Siam as that which yielded it in Ceylon could only be decided by the examination of good botanical specimens. Some years ago, Dr. Christison received from the Messrs. D'Almeida, of Singapore, specimens of Garcinia cultivated by them which had been brought from Siam as the true gamboge tree. Dr. Christison found the plant to be nearly allied to *G. elliptica* of Wallich, but differed by having pedicellate instead of sessile male flowers. Recently the author has received specimens from the Messrs. D'Almeida, and has compared them with a variety of descriptions, figures, and specimens, the result of the comparison confirming Dr. Christison's observation that but for the pedicellate flowers the plant bore a strong resemblance to *Garcinia elliptica*, and, further, came equally near *G. Morella* of Dessrousseaux. Under these circumstances he sent specimens to Mr. Thwaites, in Ceylon, for his opinion, who replied that he believed the specimen to be a form of *G. Morella*, scarcely differing from the Ceylon type, except in having pedicellate in place of sessile flowers. The author and other botanists, therefore, now describe the gamboge-yielding plant under the following names and synonyms:—*Garcinia Morella*, Dessrouss.; var. *pedicellata*. Syn.; *G. Morella*, Dessrousseaux; *G. elliptica*, Wallich; *G. Gutta*, Wight; *Hebradendron Cambogioides*, Graham; var. *β pedicellata floribus masculis pedicellatis*. The number of trees now growing on the plantation of Messrs. D'Almeida is twenty-eight. They are from thirty-five to fifty feet in height, and the largest has a circumference of three feet. They grow very luxuriantly on the side of a hillock without any attention. Gamboge has been at times extracted from them, but only as a matter of curiosity.—Professor Bentley said that Mr. Hanbury has now supplied the last link wanting in the chain of evidence to prove the true botanical origin of gamboge. He believed that there was no specific difference between the gamboge trees of Siam and Ceylon; they were simply varieties, depending probably upon soil and cultivation.

Church Bells.—The new belfry of the church of St Germain-l'Auxerrois will soon receive a set of chimes similar to those for which Strasburg, Dunkirk, Bruges, &c., are celebrated, but with the improvements suggested by the progress of modern mechanical art. M. Collin, who is entrusted with their execution, has rejected all the cumbersome old contrivances which exclude the possibility of playing several tunes except at an enormous cost. While the cylinder or barrel which works the chimes at Bruges, for instance, cost 60,000f., M. Collin's barrels will cost only 250f. each, so that as every tune requires a barrel by itself a great variety of tunes will be obtained at a very trifling cost. Instead of the enormous weights attached to the works under the old system he employs Lenoir's gas-machine as a motive power, whereby he forces air into a reservoir so as to produce a pressure of 2½ atmospheres. The air thus accumulated passes into a series of bellows, replacing the levers of the old system, and thus the artist who sets the chimes in motion finds an instrument as easy to play as a piano. The chimes will consist of forty bells, and will play two different tunes daily—one at two p.m., and the other at eight p.m.

Portsmouth Block Machinery.—A writer, under the signature of "J. B.," in a letter addressed to the *Times*, says:—"In your impression of the 17th inst. is a notice of the collection of Naval Models at South Kensington Museum, in which the block machinery at Portsmouth is said to have been 'invented by Sir Isambard Brunel, for the use of the Government, early in the present century,' and it is said that 'this invention was rewarded liberally by the Government.' Sir Isambard Brunel did not invent, nor did he ever claim to have invented, the block machinery which he had a share in setting up at Portsmouth. The original invention, or series of inventions, was by two men, father and son, each named Walter Taylor, natives of Southampton. The beginning was rather more than a century ago, and was made by the father, who had been at sea, and had been practically impressed with the inefficiency of the blocks in use in his time. After a time they took out a patent for part of their inventions, and subsequently a second patent. These included friction wheels and circular saws, both of which we owe to the Taylors. During the continuance of their patents they, under contract, supplied the Government with blocks for the navy, and for some years theirs were the only blocks used in the Royal navy. When, towards the close of the last century, their patents expired, they wished to obtain an extension of them, but the Government objected, and decided on setting up the machinery for themselves. Mr. Walter Taylor, the son, who was then making his blocks at the Wood Mills, South Stoneham, near Southampton, generously offered to the Government every facility for the purpose. The Government employed two clever young men to set up the machinery—one of whom was Mr. (afterwards Sir) Isambard Brunel, and the other Lieutenant (afterwards General) Bentham, R.E. With the benefit of Mr. Taylor's explanations these two young men examined his machinery, and then proceeded to set up machinery on the same principle at Portsmouth. Having the resources of Government to back them they improved the details of the machinery, using for it steam power instead of water power, by which Mr. Taylor's mills were worked; but in every essential point the block machinery at Portsmouth is the invention of the Messrs. Taylor. General Bentham's share in the improvements has been forgotten as much as the Messrs. Taylor's original invention. Some years ago the specifications of the patents were printed in the *Builder* newspaper, and they will enable any one of a mechanical turn of mind who wishes to ascertain how far Messrs. Brunel and Bentham were indebted to the Messrs. Taylor to do so easily. The originality of the invention was more than once publicly claimed for the Messrs. Taylor during the lifetime of Sir I. Brunel—once in your own columns—and the claim was never contested by him or by General Bentham, although, I believe, General Bentham's widow objected that too little credit had been assigned to her husband. Would it be quixotic to hope that Government, which has so greatly benefited by the invention of the Messrs. Taylor, would, at the South Kensington Museum, give some intimation of their obligations to them?"

Petroleum as Fuel.—Mr. B. H. Paul, in a communication to the *Chemical News*, says:—"Some months ago considerable interest was excited by the announcement that very remarkable results had been obtained in America by the application of petroleum as fuel for the boilers of steam vessels, and so much importance was attached to the subject, that a commission was appointed by the

Government of the Northern States to inquire into this application of petroleum. The report published by the commission, as the result of their labours, was calculated rather to excite curiosity than to afford satisfactory information, and they have not, so far as I am aware, made public any further data which would afford a means of arriving at an opinion on the subject. The proposal to use petroleum as steam fuel in ships became, almost of course, a subject of consideration in this country, and an idea prevailed that this invention might possibly supersede in importance all the recent improvements connected with the naval or mercantile marine. It was anticipated that not only naval warfare, but even navigation itself, might be completely revolutionised by this invention. It was reasonable enough that a project put forward with such pretension, as was the case in respect to the use of petroleum as fuel for steam vessels, should be considered in a country where every improvement relating to steam navigation is of high importance; but it is surprising that no one should have disabused the public mind of the erroneous impressions produced by the statements as to the use of petroleum as fuel; for to any one conversant with the composition and characters of petroleum, as compared with coal, this proposed application of it was obviously absurd. Little has been heard of this project until some days ago a notice appeared in the *Times*, under the head of 'Naval and Military Intelligence,' stating that experiments are being conducted at the Woolwich Dockyard, with the view of testing the capability of petroleum to supersede coal and other fuel on ship-board, &c. In this notice it was stated that the oil was so utilised 'as to be equal for steam purposes to five tons of coals!' How much of the oil was equal to five tons of coals was not stated, but it may be fairly supposed that any one unacquainted with the subject would infer that one ton of oil was meant. Now, what are really the facts of the case as to the comparative advantages of petroleum and coal as fuel? In the first place, one of the chief alleged advantages of petroleum over coal, was that it would lie in a small compass and make less demand upon space and tonnage than coal does. Since with petroleum in the place of coal, two-thirds of the space now required for fuel in a steam vessel would be saved, steam ships might keep at sea three times as long as at present. Then, coal depôts would be unnecessary for steam packets on the longest lines of ocean navigation; and since no stokers would be needed in using petroleum, a whole army of employés might be dispensed with. Now, the specific gravity of coal is from 1·24 or 1·44 to 1·6. while that of petroleum is from 0·800 to 0·850, consequently the weight of a cubic foot of these materials would be, respectively, about as follows:—

	lbs.	lbs.	lbs.
Coal	77·4 ...	90 ...	100
Petroleum...		50 ...	53

But, since petroleum, being liquid, lies in a more compact manner than coal, in estimating the spaces occupied by these materials, allowance should be made for the interstices or empty spaces between the lumps of coal. Taking this as amounting to one-third of the whole bulk of a heap of coals—which is a liberal allowance—the contents of a cubic foot would be as follows:—

	lbs.	lbs.	lbs.
Coal	52 ...	60 ...	70
Petroleum......	50 ...	53 ...	—

So that the spaces occupied by equal weights of coal and petroleum would be about as 1 is to 1·2 or 1·4. Then the relative heating power of equal weights of coal and petroleum would depend upon their respective chemical composition, which may be compared as follows for 100 parts:—

	Coal.	Petroleum.
Carbon	83	85
Hydrogen	5	15
Ash, &c.	12	—
	100	100

Accordingly, the relative heating power of equal weights of coal and of petroleum would be in the following ratio:—

	Coal.	Petroleum.
Calorific power	1·02	1·50

And the spaces occupied by quantities of petroleum and of coal, having equal heating power, would be in the ratio of 1 to 1·16. This difference in favour of petroleum is in itself too small to admit of any advantage being gained in regard to stowage, and it is more than doubtful whether there be any other advantageous difference between petroleum and coal for fuel. It must also be considered how far the difference between the prices of petroleum and coal would have the effect of neutralising the above, or any other advantage to be gained by the use of petroleum as fuel. The price of petroleum varies from £15 to £20 per ton, while that of coal used for steam-vessels is under £1 per ton at any part of the British coast, and even at the coaling stations in the East it does not exceed £2 10s. to £3 10s. per ton. These considerations alone appear to me to decide the question as to the practicability of using petroleum as steam fuel under any possible circumstances, for even in the case most favourable for the comparison of petroleum with coal, the cost of equal quantities of heat produced from these materials, would be in the ratio of £15 to £4. In addition to this, the highly inflammable nature of petroleum must be considered. Its storage on board a ship would require the use of air-tight vessels, and even then there might be considerable risk of the production of explosive mixture of the petroleum vapour and air. But what would be the condition of a vessel of war provided with petroleum as fuel, if a shot penetrated the vessel containing the petroleum, and allowed it to escape in proximity to the boiler fires? Taking all these circumstances into consideration, I think there cannot be any doubt as to the entire fallacy of supposing that petroleum can be substituted for coal as fuel; and though this conclusion is sufficiently evident from the data I have adopted as to price, &c., it must also be remembered that the tendency is rather to a rise in the price of this commodity than otherwise."

Commerce.

Import of Cotton.—In the first three quarters of the present year, raw cotton of the enormous value of £56,334,266 has been imported into this country, an amount equal to the sum paid for the cotton import of the entire year 1863, and far exceeding the value of the cotton import of any previous year. The value of the cotton import of the year 1860 was but £35,756,889, and the quantity received for that sum exceeded 12,000,000 cwt. Only half that quantity has been received in the first nine months of 1864 for the far larger sum first mentioned. The quantity received in the first ten months of the year was 3,076,073 cwt. in 1862, 4,226,127 cwt. in 1863, and 6,146,796 cwt. in 1864. In the first ten months of 1862 India sent us 2,190,604 cwt., and Egypt 429,464 cwt.; in 1863, India 2,611,985 cwt., and Egypt 661,104 cwt.; and in 1864, India 3,355,747 cwt., and Egypt 892,419 cwt.

Plumbago on Lake Superior.—Another extraordinary mineral discovery has been made on Lake Superior, being no less than a rich mine of plumbago (graphite). It was found on the tract of the Marquette Silver Mining Company, and it is said that Prof. Cassels, of Cleveland, who has made an assay, pronounces it the best plumbago he ever saw, and if it is plentiful, the mine is worth more than any gold mine in the country. Capt. Sweet, who is familiar with the ground, says the mine is very rich. There are several mines of very inferior graphite found in North America, the product of which is used in the

manufacture of crucibles, and for other uses in manufactures. None of it is fit for pencils. The Silver Lead region of Lake Superior must be a wonderful place if all the "discoveries" located on it amount to anything. Lead, silver, gold and plumbago appear to put the discoverers in doubt as to which they shall mine for first. Iron is close by and copper not far off. All that is needed now to complete the discoveries is tin.

Bonnets.—In the south-eastern part of Massachusetts 12,000 persons are employed in bonnet factories, and they send away annually nearly 8,000,000 bonnets and hats

Colonies.

New Zealand.—A considerable number of measures have engaged the attention of the Council of this Province (Hawke's Bay), not the least important of which is one to re-appropriate the loan of £60,000 agreed to in a former session. The appropriation now stands as follows; —£30,000 for the purchase of land from the natives: £10,000 for immigration; £1,000 for a lighthouse for Napier Port; £5,000 for a bridge over the Ngarurovo; £7,000 for the completion of the main trunk line, known as the Te Auta-road; and £7,000 for harbour purposes; the last item not to be expended until an opinion has reached us from a competent authority in England. With reference to the item of £30,000, appropriated out of the loan for the purchase of native lands, it was stated in the Provincial Council, by Mr. Ormond, one of the members of the Executive, that Mr. McLean, in his capacity of Native Land Purchase Commissioner, was sanguine of being able shortly to purchase some good lands from the natives. Should this hope be realized, the land will be set aside for agricultural purposes, so as to make the province more attractive as a field for immigration.

Another Railway in New Zealand.—An offer has been submitted to Government to make, as soon as the state of the country would allow, a railroad to Wanganui. It is to be a single line, capable of carrying an engine of not less than fifteen tons, but the offer does not include stations or rolling stock, the line to be given up piece by piece as completed. The payment asked for is land at the rate of an acre and a half for every pound sterling expended by them in making the railroad up to £4,000 per mile, that is to say, that each mile of railroad will cost 6,000 acres of land, but cannot cost more. It is proposed that the contractors should not take the whole of the land adjacent to the railway, but take it in blocks alternately with the Government.

Natal.—The *Natal Mercury* says:—"The tract of land now known as No-man's-land is about to lose that familiar and expressive name. That district has a frontage of 35 miles to the sea, a depth of 130 miles to the mountains, and an area of 5,000 square miles, or three millions of acres. About one-third of this, that is, the portion near the coast, belongs by right and cession, and it is now proposed to be so by law, to this colony. This little slice of ours is made somewhat rugged by the existence of twenty streams that flow into the sea, and the report likens it to the country between Durban and Pinetown. If this be the case we see no reason why it should not be a most valuable site for the settlement of European agriculturists. The climate of this region resembles that of Natal, being, however, slightly modified by its greater distance from the equator. There is one misfortune, however, connected with it—a population already resides there, various small tribes of Kaffirs, numbering in the aggregate 10,000 people.

Australian Coinage.—The quantity of gold-dust imported into the Sydney branch of the Royal Mint, from the 1st of January to the 16th of September, 1864, amounted to 552,885 ounces. For the corresponding period of the year 1863, the receipts were 326,014 ounces. The coin issued during the present year had been 2,006,000 sovereigns against 766,000 sovereigns and 558,500 half-sovereigns during 1863. Total value, £995,250. The quantity of gold received from Melbourne and New Zealand at the Mint accounts for this large increase in the receipts of the year notwithstanding the serious falling off in the yield of our gold-fields.

Obituary.

Mr. John Fowler, of Leeds, died on the 4th Dec. from the result of an accident while hunting. This distinguished pioneer in the application of steam power to the cultivation of the soil, was born at Melksham, in Wiltshire, in 1825, his father being a banker and merchant in that town. John Fowler early devoted his attention to mechanics. He was originally engaged in commercial pursuits, but so strong was his love of mechanics that he left the counting-house and entered the engineer's workshop. He was apprenticed to an engineering firm in the North of England, after which he went to the Orwell Works at Ipswich, where, in conjunction with Mr. Fry, of Bristol, he first made experiments in the application of steam to the drainage of land; and it was whilst he was engaged at Messrs. Ransomes and Sims' works that he made his first experiment in steam ploughing. It was also at these works that most of his engines and tackle were made, up to the time when he won the Royal Agricultural Society's prize of £500, at Chester, in 1858. While carrying out draining operations, John Fowler's attention was first directed to the cultivation of the soil by the aid of steam; and at the Royal Agricultural Society's Show at Carlisle, he arranged with Mr. Smith, of Woolston, to produce a steam engine and windlass for moving Mr. Smith's cultivator. The late Robert Stephenson, M.P., then warmly took up the subject of steam ploughing, and it was after this time that Mr. Fowler went to Leeds, where, in conjunction with the late Mr. Hewison, he erected the extensive works now in operation. Mr. Fowler, previous to erecting the works at Leeds, acquired the right to use almost all the patents for the application of steam power to the tillage of the soil; and since the establishment of the works at Leeds, a great many engines and tackle have been supplied for various parts of the world. The rapid development of the use of steam cultivation since 1859 is partly due to the fact that the war in America directed attention in Egypt and elsewhere to the extended cultivation of the cotton plant; and during the last two or three years the principal orders for steam cultivators have come from Egypt. Upwards of 300 of Mr. Fowler's apparatus are also at work in various parts of the United Kingdom, and his steam ploughs are in operation in America, Egypt, India, the Australian Colonies, and New Zealand, and on the Continent of Europe. For several years Mr. Fowler obtained the chief prizes offered by the Royal Agricultural Society of England at their competitive trials, and from most of the local societies, but it was the prize of £200 which he first received from the Highland and Agricultural Society of Scotland, to which Mr. Fowler attached the greatest importance, as he believed it led the way to the more general appreciation of the steam plough in England. At the last International Exhibition he received a medal for his steam plough and cultivator. Mr. Fowler was elected a member of the Society of Arts in 1855, and on the 30th January, 1856, at an ordinary meeting, read a paper before the members, "On cultivation by Steam; its Past History and Probable Prospects," which will be found reported in the 4th vol. of the Society's *Journal*, page 163.

Notes.

Social Science Association.—The Council of the Social Science Association have decided to hold their next meeting in Sheffield, in the autumn of 1865.

Improved Level.—At the meeting of the Institution of Civil Engineers," December 13, Mr. F. B. Doering exhibited and explained a level which, for readier adjustment, was supported upon a gimbal joint, instead of on parallel plates; and he stated that the plan was applicable to other surveying instruments. The method was similar to that adopted for a ship's compass, with the addition of vertical arcs, at right angles to each respective axis, which were clamped to each other and to the frame that was screwed on to the ordinary tripod stand. In the field, when using this instrument, however uneven the ground might be, the legs were put down in the most convenient manner, irrespective of level. The clamps holding the telescope rigid with the stand were then slackened, and the telescope set approximately level by hand. The clamping screws were then tightened, and the final adjustment effected by two tangent screws at right angles to one another, and connected respectively with each arc at the clamps. On moderately level and firm ground, it was not necessary to unclamp the joint of the instrument, as it might be set up approximately level in the ordinary way by the legs, and be brought to a perfect adjustment at once by the tangent screws. By dividing one of the arcs into degrees, the instrument might be used for measuring vertical angles, and thus the height of any point at a distance, required for checking, might be obtained. It was believed that, by this method, a level could be set up on sidelong, soft, or broken ground, with as much ease as on firm, level ground; and that, as none of the moveable parts were liable to become jammed, as in the parallel-plate system, a more perfect adjustment was practicable. A level constructed in this manner had been tried in wet weather and in high winds, and proved to be as steady as any instrument hitherto made.

Gas in Egypt.—On the evening of the 23rd September the city of Alexandria was lighted for the first time by gas, the works having been erected by a French company. The lamplighter is nightly followed in his rounds by a crowd of wondering Arabs, who insist that the marvellous blaze following the touch of his torch must be provoked by the will of a *genie*, or "djinn," as Mr. Lane would have us spell the familiar word of the Arabian nights. This improvement causes a great change in the habits of the place. Heretofore a municipal regulation had required everybody going abroad after nightfall to carry his own lantern, but this is no longer necessary.

Paris International Exhibition 1867.—It is reported in Paris that the idea of erecting a huge building over the Seine is given up—which will astonish few persons—and that the building for the next Great Exhibition will be a Crystal Palace, erected in a new boulevard, extending from the Arc de Triomphe, at the top of the Champs Elysées, to the river. The building now projected is to be large enough to give every country as much space as it may desire. It is to occupy the central portion of the boulevard, only leaving space for a carriage-way and for pedestrians, and on the other for a railway, or probably an American tramway. It is proposed to erect a steam lifting pump on the bank of the river, to supply the requisite quantity of water for all purposes.

Exhibition of Dogs in Paris.—An exhibition of this kind is announced to take place in May next. The administration of the Jardin d'Acclimatation has just obtained the permission of the Prefect of the Seine to hold the next exhibition of dogs in the Cours la Reine, between the Champs Elysées and the river, between the two bridges the Pont de la Concorde and the Pont des Invalides, and consequently in a much more accessible position for the general public than the gardens of the Society in the Bois de Boulogne, where the first dog show took place last year.

Correspondence.

Radial Locomotives, Spring Tires, and Wood Wheels.—Sir,—In the discussion on my paper of Dec. 7th, Mr. Teulon said that, "all changes on railways must be made with great caution;" and here I agree with him, though possibly we may differ in our modes of verification as to tests. I think it quite possible to do it rapidly, as iron beams are tested to breaking by heavy loads, while possibly Mr. Teulon might be disposed to apply the test of time with an ordinary load, and so carry his experiment over thirty years or more. It is better to make a positive experiment than a negative one. With regard to my radial engine, positive experiments have been made with it during the last eighteen months, and a body of the most eminent railway engineers have experimented with it; and I am authorised to say that in the proceedings of the Institution of Civil Engineers, not yet published, on the occasion of a paper read by Mr. Cross, the engineer of the St. Helen's line of railway, my radial engine was approved of by Mr. Hawkshaw, Mr. Charles Hutton Gregory, Mr. Vignoles, Mr. T. E. Harrison, Mr. G. Berkeley, and others, without a dissentient voice. Mr. Teulon, in addition to being a member of the Council of the Society of Arts, is also a Director of the South-Eastern Railway, and Chairman of the Committees of Rolling Stock and Way and Works. It is, therefore, very important that he should be accurate in all his statements, but it is clear that he is not what the Americans call "posted up" in the early details of mechanism on the South-Eastern, and especially in the history of the wood wheels thereon. The first wood wheels were mine, and applied to some carriages built by me for the opening, when Mr. Baxendale was chairman. These wheels were composed of centres of cast iron discs, surrounded by two circles of fellies dowelled together break joint, each row being four inches in depth, on which the tire was shrunk by heating and cooling in the absence of a machine for pressure. The results of these wheels were so satisfactory that I subsequently applied solid discs of radial timber to cast iron centres for the same line, when the tires were applied cold by pressure, being secured in their places by the retaining rings of Mr. Mansel. This arrangement of end timber was not so good as the side grain of the former wheels. The present mode on the South-Eastern is a circle of wood fellies, about an inch in thickness, placed between an iron wheel and the tire, but the tire is heated and cooled to apply it, and this is not desirable, cold pressure being the safest. The principle is, in fact, precisely the same as in my earlier wheels. The true plan, in constructing such wheels, is to bend a piece of straight-grained timber into the form of a hoop, and place it within a tire rolled with a front flange, forcing the wheel into it with the tire cold by hydraulic pressure, and then securing it with a flat ring at the back, sprung into a shallow groove. In this made the retaining rings and bolts may be dispensed with, and the whole structure much simplified, as shown in a specification of mine, older than that of Mr. Mansel, quoted by Mr. Teulon. But even when made in the best mode, there is a serious defect when the two wheels are rigidly fixed on one shaft, by the torsion of the axle on curves and irregularities of the rails, though the wood packing tends to lessen the mischievous vibration. And there is another defect, in the contingency of using wood not properly dried, which may occur when manufactured on a large scale. It is well known that ordinary road wheels, if they stand long in the sun in dry weather, get loose, and require soaking in water to tighten them. A number of wood railway wheels were sent to India, in which discs of wood were applied between tire and centre. When unshipped a Lancashire inspector described them as

"tumbling to pieces and the discs rolling up and down the beach like so many cheeses." There is another objection. If a tire bearing on wood gets loose, the wood will grind away as it revolves, and be spoiled. It was for this reason that I turned my attention to the desirability of getting rid of the wood altogether, and substituting an elastic hoop of tempered steel. The result of this has been thoroughly satisfactory. It is evident that the only value of the wood is as a cushion and not as a flexible spring, and that it cannot slip upon the tire to compensate for varying curves, and prevent torsion of the axle. But the flexible spring does permit of slip of the wheel within the tire to prevent mischievous torsion of the axle, and it does also permit of horizontal variation in the tread to prevent unequal bearing, with a positive flexible yield to absorb blows; while in the case of a loaded driving wheel it permits a certain amount of flattening on the tread and an absence of jumping, which is very favourable to increased adhesion. And as the tension cannot be excessive and cannot be increased in time of frost, there is no risk of bursting the tires, while they can be removed and replaced without taking the engine or carriage into workshops. The remarkable results obtained in increased durability only require to be widely known to ensure their adoption generally, and the more especially in countries where repairs are difficult, and durability, above all, desirable. The reduction of wear in the tire surfaces permits them to be made considerably thinner and consequently of better metal, and prevents that mischievous fly-wheel action resulting from wheels with heavy peripheries. Mr. Teulon's remarks on the possibility of incessant travelling by rail would be better corroborated by individual names, tabulated, and stating distances, how many days together, and for what period of time kept up, sex, age, height, proportions, complexion, temperament, &c., all given by a medical man. These would be statistical facts to set against the general impression of injury to health.—I am, &c., W. Bridges Adams.

MEETINGS FOR THE ENSUING WEEK.

Tues....Ethnological, 8. 1. Mr. John Evans, F.R.S., "On Flint Implements from Salisbury Hill, near Bath." 2. Mr. Khanikof, "Contributions to the Natural History of the Iranians." 3. Mr. W. Martin Wood, "The Hairy Man of Jesso."
Royal Inst., 3. Prof. Frankland, "On the Chemistry of a Coal." (Juvenile Lectures.)
Actuaries, 7. Mr. Peter Gray, "On a Table for the Formation of Logarithms and Anti-Logarithms."
Thurs...Royal Inst., 3. Prof. Frankland, "On the Chemistry of a Coal." (Juvenile Lectures.)
Sat.......Royal Inst., 3. Prof. Frankland, "On the Chemistry of a Coal." (Juvenile Lectures.)

Patents.

From Commissioners of Patents Journal, December 16th.

Grants of Provisional Protection.

Agricultural produce, machinery for cutting, &c.—2970—R. Maynard
Atmospheric air, purifying, &c.—2937—J. White.
Bells—2956—J. Evans.
Boats, propulsion of—2899—J. Macintosh and A. H. Thurgar.
Boots, shoes, &c., apparatus for eyeletting—2957—M. F. Heinzmann.
Bricks, machinery for making—2972—G. Axton and J. Leach.
Bromine and bromides, obtaining—2948—L. Leisler.
Bubbles from soapsuds, apparatus for blowing—3047—W. E. Newton.
Cannons, &c.—2947—R. W. Sievier.
Carriage axles and boxes—3063—E. Partridge.
Carriages, apparatus for indicating the time engaged, &c.—2978—J. Pinaud.
Cigar of other materials than tobacco—2977—J. D. De Boulimbert.
Clockwork—3033—W. E. Gedge.
Coprolites, apparatus for washing—2936—T. Perkins.
Cotton fibre, apparatus for separating from seed—3009—E. A. Cowper.
Deep sea soundings, apparatus for taking—2980—A. E. Dobbs.
Dye-stuffs, purple—2894—W. V. Wilson and J. A. Wanklyn.
Engines, feeding of scribbling and carding—3007—G. Wailes and B. Cooper.
Engraving, apparatus for—2941—P. E. Gaiffe and E. Zglinicki.
Feathers, &c., metallic ornamentation of—2944—W. Clark.
Fibrous materials, machinery for combing—3065—W. Tongue.
Fibrous substances, fuel, &c., presses for—2707—G. Ashcroft.
Fibrous substances, opening and scribbling—2921—P. Garnett.
Fire-arms, breech-loading—2907—J. Leetch.
Fish, preparing and potting the roes of—2986—J. Banger.
Fuel, combination of materials to be used as—2852—A. Wall.
Furnaces, condensing and collecting products volatilised in—3035—W. T. Watts.
Fuzees—3015—C. W. Lancaster.
Gas, apparatus for heating and cooking by—3013—R. A. Brooman.
Gas, escapes of, apparatus for indicating, &c.—2984—M. Henry.
Gas, regulating the supply of—3039—J. Keeling.
Heavy bodies, trucks or carts for carrying and elevating—3031—H. Lamplugh.
Hooped skirt, manufacture of—2760—A. V. Newton.
Hydraulic presses—2942—E. Cottam.
Hydro-beer pumps—2968—W. Jackson and W. Glaholm.
Letters, balances for weighing—2885—W. Clark.
Liquids, method of cooling—8923—F. Millns.
Marine steam boilers, construction of—2565—W. E. Newton.
Marmalade, preparation of—2938—W. Keiller.
Metals, obtaining dense and flawless castings of—2831—G. Bell and R. Luthy.
Mills for grinding grain—3025—J. Goodier and T. Lee.
Minerals, machinery for cutting—2962—W. E. Carrett, J. Warrington, and J. Sturgeon.
Motive power, apparatus for generating—2803—W. Clark.
Paper, manufacture of—2963—J. R. Crompton.
Pipes for smoking—2952—T. B. Laws.
Pumps—3005—T. W. Gray.
Railways, diminishing wear and risk on—2764—W. B. Adams.
Railways, permanent way of—3055—J. Livesey and J. Edwards.
Railways, signalling and giving alarm on—2767—J. Henshaw.
Railways, switches or points for—2950—T. Knowles.
Reaping and mowing machines—3043—W. J. Burgess.
Rice, apparatus for cleaning—3027—J. Yearsley and E. Timbrell.
Roofs, walls, &c., construction of—2647—R. W. Wilton.
Sewage, deodorising and utilising—2832—G. E. Noone.
Shafts, reducing the friction of—3003—M. J. Roberts.
Ships, compound for coating the bottoms of—3049—A. D. Hall.
Soap, machinery for cutting into bars—3061—A. V. Newton.
Spinning machinery, giving pressure to the drawing rollers of—2992—J. McIntosh.
Steam boilers, apparatus for feeding—2940—L. Valant.
Steam boilers, feeding—2988—E. M. Shaw.
Steam boilers, generating steam in—2976—A. Wheatley.
Steam engines—3011—J. France.
Steam engines and rotary pumps—2960—T. Greenhalgh.
Table covers—2946—W. Ward.
Textile fabrics, preparing to be oiled for packing—2964—J. Smith.
Umbrellas, parasols, and sun-shades—3037—J. Stephenson.
Ventilating cupola chandelier—2934—F. Sang.
Wadding, &c., manufacture of—2709—E. Pilkington.
Warming and ventilating apparatus—2932—J. Kissack.
Wool, separating or recovering the fibres of—2958—J. Rowley.

Patents Sealed.

1523. R. Jones.	1591. W. D. Napier.
1525. R. Smith & C. Sieberg.	1602. C. Denis.
1527. A. Smith.	1620. W. Clark.
1531. T. Worsdell.	1747. G. W. Pitcher.
1532. T. Mayor.	1855. T. Dixon.
1541. H. Phillips.	2018. E. Andries.
1549. I. Buckley & E. Crossley.	3061. F. G. Underhay & R. Heyworth.
1550. John Bottomley.	2097. H. Potter.
1551. E. A. Inglefield.	2230. H. Potter.
1580. J. Hinks and J. Hinks.	2326. H. Potter.
1581. A. Knowles & J. Barraclough.	2420. E. Loysel.
1588. W. A. Guy, E. Edwards, & R. W. MacArthur.	2442. G. T. Bousfield.
1589. R. W. MacArthur, A. Guy, & E. Edwards.	2443. J. Johnson and T. Johnson.

From Commissioners of Patents Journal, December 20th.

Patents Sealed.

1542. W. Carrington and T. Turner.	1607. H. C. Steane and F. A. Steane.
1543. T. O. Dixon.	1622. J. H. Wilson.
1545. J. Forbes.	1655. W. E. Gedge.
1546. A. Smith.	1663. G. H. Palmer.
1547. T. J. Denne.	1668. W. E. Newton.
1556. C. Hepstonstall.	1743. W. L. Wise.
1561. J. Jones.	1813. W. E. Newton.
1567. G. Carter.	1847. J. H. Johnson.
1572. J. Smith.	1860. J. H. Beattie.
1576. R. Cochran.	1863. G. Furness and J. Slater.
1579. J. Bailly.	1973. P. A. J. Dujardin.
1595. J. Hay.	1998. A. B. Childs.
1599. B. F. Stevens.	2285. E. Slaughter.

Patents on which the Stamp Duty of £50 has been Paid.

3111. R. Searle.	3177. J. M. H. A. Taurines.
3140. R. A. Brooman.	3291. T. Green, W. Green, and R. Mathers.
3141. R. A. Brooman.	3225. F. Laurent & J. Casthelaz.
3179. C. Pontifex.	3239. T. Silver.
3183. E. Stott.	147. E. C. Nicholson.
3222. T. E. Vickers.	191. J. Alison.
3258. J. B. Payne.	3166. R. Scott.
3270. W. E. Newton.	3181. T. Bourne.
3197. J. Redfern.	

THE

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AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, DECEMBER 30, 1864. [No. 632. VOL. XIII.

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Announcements by the Council.

ART-WOKMANSHIP PRIZES.

The Articles sent in competition for the Art-Workmanship Prizes are now arranged for display in the Society's Great Room, and the Members of the Society, as well as Art-Workmen, are invited to inspect them daily between the hours of 10 and 4.

To suit the convenience of Artizans, the Exhibition will be open on the evenings of Wednesday, Thursday, and Friday next, from 7 o'clock to 10.

The Council have invited a Special Meeting of the Exhibitors and Friends for Monday evening next, at 8 o'clock.

Proceedings of Institutions.

BINGLEY MECHANICS' INSTITUTE.—The completion of the new Mechanics' Institute at Bingley was inaugurated by a soirée on the 14th of November. The Institute is built from the designs of Mr. Waterhouse, of Manchester. The style of architecture is Gothic, and the building forms a prominent and attractive object in the main street. The Institute consists of a large school-room for the accommodation of the evening classes; four class rooms, for the teaching of the more advanced branches of education; a library, news-room, and a large hall for the delivery of lectures. The hall is capable of accommodating upwards of 500 persons. ALFRED HARRIS, jun., Esq., the President, occupied the chair, and amongst a large number of gentlemen who supported him were E. Baines, Esq., M.P., W. E. Forster, Esq., M.P., Alfred Harris, Esq., Isaac Holden, Esq., Mr. Alderman Law, Rev. A. P. Irwine, M.A., Samuel Rhind, Esq., Thomas Baines, Esq., Rev. A. McKechnie, Capt. Ellis, Bingley; H. Illingworth, Esq., Bradford; J. Oddy, Esq., Birkenshaw; T. Horn, Esq., Morton; E. Sharp, Esq., A. Sharp, Esq., J. N. Thacker, Esq., Mr. W. E. Skirrow, Mr. B. B. Skirrow, Mr. J. Dickenson, &c.—The CHAIRMAN said —The inauguration of this new building is an event which has been for several months looked forward to with great interest by most of the inhabitants of our town; and in now meeting to celebrate it, we may safely say that the anticipations which have been formed of the general appearance of the building—of its convenience of arrangement, and general adaptability to the purposes for which it is intended—are fully realised. It will, I am sure, be evident to all who are here this evening, that this building is one which is likely to give scope for a great spread of educational influence in our town. It will be surmised that the result we have attained could only be arrived at by a considerable outlay of money. The cost of the building and furniture, including the various items for heating, lighting, and decorating, will not fall short of £2,600 when all is completed, and the subscription list, standing still at £1,410, causes us some little anxiety as to the pressure of the heavy balance of debt on the Institution. A Mechanics' Institute was first founded in Bingley by a few friends of education in 1832. After a languishing existence of five years it came to an untimely end, but was renewed in the year 1840. It continued on a small scale, with more or less success, until 1849: in that year the rooms were taken in which it has been carried on up to the present time. At the annual meeting in 1863, the number of members was 341; this year it is 411. The increase has been principally in female members: last year these numbered only 26, this year there are 68. In the library there are 1,196 volumes of books. The books have been much better read in the current year than in the year preceding, the issues being 5,008 in 1863, against 6,112 in the current year. These numbers show that the members have made a diligent use of the small library which we possess. During the past year lectures have been delivered by the Rev. P. A. Irwine on "Mahomet," Rev. J. Ward on "Earthquakes," Rev. Mr. Heron on "Young Bingley," Mr. W. Newsome

on "Self-Culture," and Mr. N. Walbank on "Crusades." A penny bank, in connection with the Institute, has been several years in operation. The influence which literature exercises over the minds of young people, especially those who seek it of their own accord, either for instruction or for amusement, is so great that Mechanics' Institutes should furnish to their members the very best class of reading, and works in each department of literature should be carefully and judiciously selected for the library. I am by no means an advocate for placing in the hands of our members dry and abstruse treatises or works of a nature too learned for the general abilities of the readers for whom we have to provide; but there are now many works published which it is desirable for these Institutions not to encourage—works which are not wholesome intellectual food, and the reading of which neither enlightens the mind nor elevates its moral susceptibilities, works which do not give a true picture of human life, but which appeal to the lower feelings of man's nature, by gross exaggerations of the vices and follies of the vicious and foolish of our species. The influence of works of fiction on the mind is by no means to be under-estimated as an element in mental culture, especially for the hard-strained sons of toil who seek, and justly so, in their literary pursuits, relaxation from the hard stress of labour; therefore, in selecting works of this class from the large field now laid open to the reading public, we should exercise much discretion, so that we may place before our members a good and wholesome intellectual diet, scrupulously avoiding all that is of a baneful or poisonous nature. It may perhaps surprise some of our friends from a distance to hear that the young lads of Bingley, to the number of 100 and upwards, are regular attenders at the night school, and may be seen zealously plodding over their slates and copy books of an evening, instead of wasting their time in idleness or vice. The girls' school, too, is in a flourishing condition, and is attended by about 50 of the female members of our Institute. Whilst these facts are very encouraging, we feel that a wider task is opened before us, and that we must try to lead on our young members who attend the evening schools into higher knowledge and more noble attainments. French and German are now becoming necessaries of commercial as well as of intellectual life—they should be freely encouraged here for those who desire to learn and who will afford the necessary time and cost to attain them. The study of history, a most important branch of education for the working classes, should also find its votaries within these walls—and a well-regulated course of historical study requires the mechanism of master and pupils to make it efficient. Mathematics and mechanics, too, are highly important to our working men in this district, where each man earns his bread by directing and assisting those great forces, steam and iron, which, brought under the control of human intellect, have been moulded and framed into machinery whose magic power is only equalled by its fairy fineness. The number of members attending the drawing-class is but small, yet if our working men and women knew that one of the greatest requirements of our age is experienced art-labourers, they would consider rather seriously whether within themselves may not lie concealed the germs of that glorious faculty which enables mankind to create worlds of beauty, of grace, and of comeliness, out of materials low and base in themselves. I repeat that one great want of our age, in architecture, in pottery, in manufactures of every kind, is an array of art-workmen and art-workwomen; and I assert that more agreeable, more noble, and more profitable employments, available for the poorer classes of our population, do not exist than those of skilled art-workmen and designers. But in these departments spurious knowledge is worse than worthless, it is positively baneful—therefore the necessity of earnest study in their attainment. I know great difficulties have to be overcome in the study of art (as in all other noble studies), and one of these is the temptation to the young student to become an artist. If any young men are here who are studying at the drawing class, my advice to you is, learn what is useful, not what is fine; learn what you can apply to your trade, what will help you in earning your daily bread. Don't strive to paint pictures except for your own amusement and pleasure. You may learn to succeed in drawing models for machinery, in applying your knowledge to stone-cutting and wood-carving, or you may learn to design a pleasing combination of colours, or a simple pattern for a dress-piece; but do not be led away by the idea that you will paint pictures which will sell, because you will, as a rule, only experience disappointment if you are. The name Mechanics' Institute hardly conveys a proper notion of the actual composition of a society like ours. The members in this Institution belong to all classes of society, from the gentry of the neighbourhood and the master manufacturers down through the various grades of tradesmen and shopkeepers, shopmen, overlookers, clerks, farm labourers, combers, weavers, and spinners; resting thus on the broadest possible basis, it stands safe against the accusation of being subject to any class or party interest; and it is of the utmost importance that this broad basis should be carefully preserved; and also that every adult member should feel a personal interest in seeing that the management is confided to those in whom entire trust can be reposed, and who will work the Institution for the general good of the whole body of members, without party or sectarian leanings. In the early days of Mechanics' Institutes, it was considered by some, who had the welfare of the people at heart, that it was desirable not only that they should be principally composed of, but that they should be entirely conducted by, working men. At first sight there may be reasons which commend this view of the subject, but I never could agree with the propounders of the theory; for I am strongly of opinion that one great benefit resulting from Institutions of this kind is the friendly intercourse which they promote among the various classes of the community, and the creation of kindred interests and feeling between them by the kindly co-operation of rich and poor, of high and low, in one common object—the alleviation of moral want, and the supply of mental food to those whose position in life may prevent them from obtaining it elsewhere. I believe that these good feelings and sympathies between class and class do grow out of these Institutions when conducted on sound principles—that good results are produced to all who impart or receive their advantages—and that all who attempt to narrow the basis on which their moral structure should rest, by centralising the control of them in any one class, are not the true friends of the working people. Our own Institution is a fair sample of the results of united efforts among the various classes of our townspeople. Had it not been for the active help and liberal donations of the middle and upper classes, it would have been impossible for this Institution to have possessed the handsome building in which we are now assembled, and which may be regarded as an inheritance committed to trustees by the friends of education and mental enlightenment for the benefit of all classes of the inhabitants of this town, but, of course, especially for the benefit of that large, hard-working, and industrious class of artisans, who could not have obtained such an advantage for themselves, except by sacrifices which it would have been hard for them to make, and unreasonable to have been expected from them; no further stipulation being required from those who enjoy it, but a steady adherence to the principles on which this Institution is founded. And again, had it not been for the hearty support which the Institute, on its old basis, received from the working population, there would not have been a sufficient inducement for the middle and upper classes to come forward, as they have done, to supply the want of increased accommodation so keenly felt by the members. Here, then, we see an example of what may be done by the kindly co-operation of class with class. And it may be felt as a cause of

thankfulness by some that they may impart, and by others that they may receive, the benefits which the Giver of every good and perfect gift places it in the power of one man to give and another man to enjoy. —Mr. E. Baines, M.P., referring to the many branches of education in science and art which might be embraced in the curriculum of the Institute, urged the importance of the members taking part in the examinations instituted by the Universities of Oxford and Cambridge, and illustrated the value which was attached to one of their certificates by relating the case of a young man—an old member of the Leeds Mechanics' Institute—who obtained an excellent situation in the back States of America by producing as his reference such a certificate. It was not merely a certificate of a certain amount of requirements on the part of the man; it was a certificate of habits of application that had been learned in the Institution and of the good effect produced on his moral character by his connection with the Institution. He then alluded to the superior advantages enjoyed by the young men of the present day over those enjoyed when he was a young man, and referred to the increase which had taken place in cheap, good, and abundant literature to an extent which not even the most sanguine could have dreamt of thirty years ago. From the year 1831 to 1864, the issue of newspapers in the United Kingdom had increased more than thirteen-fold, and that of serial publications more than fifteen-fold. As regards the quality of these publications, he might mention that of the 3,600,000 copies of serials issued monthly in London, 1,900,000 were positively religious magazines; one quarter of them were issued by the advocates of temperance and total abstinence, and the rest were magazines of a high literary and scientific character. The circulation of the weekly publications was 2,500,000, and of these one-fifth were distinctly religious; one-third were of an educational and literary order; two-fifths were novels, tales, and biographies of an unexceptionable character, and only one-twelfth were of that directly immoral and impure character to which he supposed the Archbishop of York referred, when, in a recent speech, he condemned sensational novels, and those romances which were calculated to excite wonder and horror—such miserable trash that he wished there were none of them. Only 9,000 copies out of 2,500,000 published weekly had an immoral tendency, and he found that three years ago the number was 52,000. Those issued of a sceptical or decidedly irreligious character only numbered 5,000. With the advantages conferred by Institutes like the present, and by such a large mass of valuable, pure, sacred, moralising, elevating literature, the young men of the present age ought to be a more enlightened, more active body than their fathers could by any possibility be. He hoped that to the hard heads and good principles of their fathers the young men of Bingley would add that knowledge which would make them more useful to themselves and to the world around. After alluding to the recent working men's industrial exhibition in London, as proving that the working men of England could turn their talents to other trades besides their own, and that a change of occupation was more of a relief and amusement to working men than time spent in frivolous amusements, Mr. Baines concluded by recommending the Committee of the Institute to issue a circular yearly to the youths who were retiring from school, inviting them to become members, and also take an active interest and sympathy in their studies.—Mr. W. E. Foster, M.P., congratulated the assembly upon the inauguration of their Mechanics' Institute. They had certainly got the most handsome building of the kind he had ever seen. When Mechanics' Institutes were first started, under Dr. Birkbeck, they were a little too ambitious, and thought it would be possible to dispense altogether with elementary teaching and to give the working man a superior education. It was found, however, that artisans did not possess that elementary education which would enable them to take advantages of the higher branches of learning, and the result was that these Institutions fell away from their original design, and they became Institutions more for the education of the middle class than the instruction of the mechanic. These Institutions had found that they could not impart a superior education to the working man until he became master of elementary learning. Consequently, elementary night schools were acknowledged to be one of the principal objects of Mechanics' Institutes, and he did not think that there was anything that did so much good. He hoped that no person would feel discouraged in acquiring elementary learning, because he had not had the advantages of early learning. He had had at his house, when on a visit to this neighbourhood, a very gentlemanly man, who did not learn to read till he was twenty-one or twenty-two years of age, and yet he was now a very able and intelligent man. He believed that it was only this year that this same man, at the meeting of the Association for the Promotion of Science, at Newcastle, made a speech in defence of a particular theory, and which was acknowledged to be by far the best speech on the occasion, even in a discussion amongst scientific men on a scientific question. This man was William Craft, the Negro, and formerly a slave. They need only take the example of William Craft as an illustration of what a man might effect for his improvement when he had a determined purpose. He was glad to find that there was a class for the study of the French language connected with the Institute. A knowledge of the French language was becoming of more importance every day. Now that there was a large trade between this country and France, it was necessary that all those who were employed in this trade should have associated with them those who were competent to speak and write the French language. A knowledge of the French language, therefore, would be of the greatest advantage to young men in enabling them to obtain better situations and to promote their own advancement. It was the duty of all to promote the education of the people to the fullest extent. Whatever progress was made in England, he believed that the West Riding would be in the van. It was more necessary that in this district the working classes should be prepared to assert their position in the van of England's progress. What they were doing at Bingley was a proof that they understood the position they were destined to occupy.

Llanelly Athenæum.—On Friday last, 23rd December, Mr. F. E. Bodkin concluded a course of four lectures on Geology, which he has delivered at this institution. Mr. Bodkin has kindly taken the trouble of classifying and arranging a large collection of minerals presented to the institution by Lord Cawdor, and had at the earnest request of the managers consented to deliver the lectures in question, which have been extremely well received; a cordial vote of thanks having been tendered to the lecturer at the termination of his voluntary and gratuitous labours. Mr. F. Bodkin is the grandson of the Assistant-Judge, one of the Vice-Presidents of the Society of Arts.

St. George's and St. James's, Westminster.—On Friday, 23rd December, a public meeting of the St. George's and St. James's local board for promoting the education of adults, in connection with the Metropolitan Adult Educational Association and the Society of Arts, was held in the lecture theatre of the School of Mines, Jermyn-street, to explain the objects of the board, the system of examinations, certificates, prizes, &c.; Wm. Hawes, Esq., in the chair. The Chairman said the objects of the association were very important. In former times young men had no means of testing their abilities or acquirements; but when the Society of Arts established the system of examinations, conducted by the agency of local boards, every man could offer himself for examination. The chairman proceeded to detail the objects of the association, and urged the young men and women employed in the district in shops and other avocations, to join the association with a view to future improvement and success.—Dr. Drewitt proposed the first resolution—

"That it is desirable to promote as far as possible the education of adults; that the present time, owing to the early closing movement, furnishes a fitting opportunity for carrying out the object, and that this meeting pledges itself to use its best efforts for the purpose;" this was seconded by the Rev. Mr. White, and unanimously adopted. The Rev. Mr. Macilwaine, in moving a resolution acknowledging the steps which had been taken by the Society of Arts and the Metropolitan Association for the Promotion of Adult Education, expressed an opinion in favour of local organization as the best means of rendering those steps more effective. The motion was seconded by the Rev. Mr. Edwards and unanimously agreed to. A resolution to the effect that the union of interests between the inhabitants of the parishes now appealed to afforded special facilities for the formation of a united local board in connection with the present association and the Society of Arts, was also unanimously agreed to; and the meeting then separated with votes of thanks to the Duke of Marlborough for accepting the office of president of the local association, to the committee of Privy Council on Education for the use of the theatre, and to the chairman for his conduct in the chair.

DUBLIN INTERNATIONAL EXHIBITION, 1865.

The Belgian Commission (at whose head is placed M. Fortamps, the able Commissioner in 1862) have forwarded the list of their own manufacturers who purpose to become exhibitors. Lace, of course, occupies a prominent position, and we are able to report that Belgium will be remarkably well represented in this important branch of industry. The well-known firm of Cail, Halot, and Co., have promised railway and agricultural machinery and engine-tools. Chemical manufactures will include ultramarine, soaps, and perfumery. Liége will send a large display of arms, especially rifles; and Ghent a collection of leather goods. Metallic manufactures, glass, and china, are all to be well represented; it is only necessary to mention the name of Dufour among the goldsmiths, Demol for porcelain, and Bogaerts for bronzes. The names of contributors to the Fine Art section are too numerous to quote; but we are assured that the best specimens of the modern Belgian school of painting will have a place in the Exhibition. Among the painters, Billoin, Kindermans, Keelhoff, Roffiaen, Van Moer, Van Severdonck, Verboekhoven, and Willems, are already known by their works in the Great Exhibition of 1862. Among the sculptors and medallists, we may, for a similar reason, specify Fraikin, the two Geefs, and Wiener.

INVULNERABLE AND UNSINKABLE SHIPS OF WAR.

By J. Kennedy.

If in theory the science of attack has no limit, neither has the science of defence; the latter will develop with the former. A big and powerful gun means a big and powerful ship; and if ships are to be armed with 300 and 400 pounders, the defensive armour on the exposed parts of the ship's hull must be made to resist this gun, for it will not do to let the projectile get inside of the ship or pass right through, as it might enter just above the water-line and pass out on the opposite side below the water-line, and so bring about the destruction of the ship. A ship may be shielded to effect this object, though her dimensions must be augmented, not by adding to the length, but by increasing the beam considerably. The height of the solid work (a top height) above the water-line being exposed surface, and having to be covered with armour, is a fixed particular; for, whatever the other dimensions may be, she must—for a comfortable ship when cruising at sea during bad weather—have a certain height of top-side out of the water, or else the upper deck will be constantly swept by green seas. This height may be limited to ten feet above the loaded water-line, when ready for sea, in the case of all iron-clads, though it precludes the use of broadside guns as carried by the *Warrior* and her sister ship. This surface above the water line tumbles home very considerably, and is convex throughout, fore and aft. The proposed descriptive dimensions of this ship are:—For length on the loaded water-line, 400 feet; breadth outside, 82 feet, and depth in the water as she would be ready equipped for sea, 22 feet; tonnage, builder's measurement, 12,546 tons; loaded displacement to 22 feet depth, 13,500 tons, with a formation of immersed surface which at all points will offer the finest angle of contact to the water particles during a direct motion; with due inherent stability for resisting the momenta of all the weights carried aloft, viz., defensive armour, turrets, and guns, &c., when oscillating heavily in a rolling sea-way, and thus avoid the necessity for carrying counter-weighting; without any vertical surface at the extremities, as gripe and heel, or dead wood, which opposes the lateral motion of the bow and stern of the ship during steerage, and gives the rudder more work to do: and with a double or biformation of the ends fully developed at the after body and partially at the bow body; an easy bilge section outside the midship longitudinal body, which is 30 feet wide; parabolic, horizontal, and diagonal sections, and elliptical cross-sections of the outside longitudinal bodies, and fitted with two propellers and two rudders upon the double after ends, the propeller shafts being hinged at some distance from the propellers, to allow the propellers and shafts to be hauled up together into suitable recesses in the counter, a ready way of disposing of them when canvas has to be the only propelling power.

The outer shell of the hull may be precisely the same as any ordinary iron ship, being virtually one unbroken skin up to the top-height. The armour, which is carried inside of this shell upon shelves of sheet iron 12 inches apart, consists of slabs of rolled or hammered iron of any convenient length, with a triangular or wedge-shaped section six inches deep at the thick edge, and twelve inches broad. These are piled flat way on the shelves, one above another, thick and thin edge alternately having layers of felt placed between each. The whole depth of the armour is then substantially backed up by stout iron framing and truss work from the inside, which is continued down to the flat floor. Strong diagonal braces of iron connect the upper portion of the ship at one side with the bilge on the other. These are any convenient distance asunder, and need not interfere with a free course throughout the ship between decks. They will impart great stability to the armoured portion of the ship's hull, and prevent any vibration taking place.

After the necessary space has been set apart for the engines and boilers, coal bunkers, powder magazine, and for the stores and equipment, the remainder of the space in the hull below is divided off into numerous well spaces, which are to be ten feet square, and from the lower deck down to the flat floor. These well spaces are made by dividing this portion of the ship off by means of vertical partitions or bulkheads, fore and aft and athwart. These partitions are to be of thin iron or steel, and a few of them will be continued up to the upper deck. They will thus impart great strength and rigidity to the structure, as well as render the ship less liable to be sunk. The upper deck beam plates are covered above and below by thin iron sheeting, to enclose a water-tight space partitioned off, which corresponds to the depth of the beam plate. Some hundreds of tons of floating power can thus be gained. The lower deck consists of iron sheeting carried over the upper edges of the transverse and longitudinal bulkheads. No beams are required at this deck. Man-holes or doors are made over each well space. A double skin throughout the bottom, giving a space of some 24 inches, would be a further advantage, by way of diminishing the chances of sinking. By way of a further

precaution against the liability of these iron ships to sink without giving any warning, all the spare room below the 'tween decks is occupied by thousands of light, hollow, spherical vessels. These are made of steel, or malleable iron of very tough quality. The figure of the sphere or globe, being that capable of offering the greatest resistance to external pressure, is preferred. They may be 24, 36, and 48 inches in diameter. A sphere 48 inches in diameter contains 31·51 cubic feet in the solid, and 500 of them would be equal to 16,755 cubic feet, which, reduced to tons of water, equals 478½ tons, and if we allow five tons for the weight of metal in them, they yield 473½ tons of floating power. This shows that were these hollow spherical vessels placed in the compartments, not otherwise occupied, in sufficient numbers, they would guarantee the ship from being sunk under the most destructive fire from forts or ships. The chances would be very much in favour of a ship so provided with this description of floating power holding out to the last. In preparing a ship to go into action all the available space, even between decks and in the engine-room and about the boilers, might be filled up with these spherical hollow floating vessels, for all that can be done in this respect, no doubt, would be only a prudent precaution against instant destruction by sinking.

As regards the means of obtaining sufficient numbers of these hollow globes, they may be manufactured by existing machinery, and turned out in considerable numbers by a few men and boys in a very short time; and, as one essential property they must possess is extreme lightness, the quantity of metal used up in their manufacture will be very small, and the cost, therefore, will be comparatively trifling compared with their immense utility.

The problem of how to apply iron, steel, or any other suitable metal of excellent quality, to the construction of ships of war or other vessels, so that the greatest amount of strength with lightness may be gained, and at the same time to render the structure incapable of being sunk until it is absolutely broken up, is a very simple one, and may at once be practically resolved, whilst the question of invulnerability to attack by 400-pounder guns depends upon providing a ship of sufficient buoyancy, with great proportionate beam, and in doing away with the present broadside armament as carried by ships of the *Warrior* class.

A ship of the above description, in lieu of broadside guns, would have two rows of fixed turrets carried on the sides of the upper deck, close up to the waterway, and a turret at each extremity of this deck—ten turrets in all—armed with two guns in each, of the heaviest calibre, with sheet-iron bulwarks arranged between the turrets, adapted for sliding down inboard.

Fine Arts.

Descriptive Labels in the Louvre.—An excellent method of furnishing the public with information respecting works of art is now being put into practice in the gallery of the Louvre. Tablets, on which are inscribed the subject of the adjacent pictures, together with the names of the artists, the dates of their births and deaths, and the title of the school to which they belong, have been placed, at intervals of about six yards, along a portion of the Italian department of the gallery. These tablets are conspicuous enough to attract attention, and cannot fail to make many persons, unversed in matters of art, think a little, at least, about the pictures, which otherwise they might, and very often do, regard as mere pretty curiosities, and this will be a real step towards art education.

Sales of Works of Art in Paris.—The true fine art season in Paris will commence with one of the most important sales that has taken place for a long period, the famous collection of the late Comte de Pourtalès-Gorgier, who died ten years since, known as the Pourtalès gallery. The sale is divided into ten portions, to occupy thirty days, and is spread over the period commencing with the sixth of February, and ending on the fourth of April. The catalogue is divided into three portions—objects of art and curiosity, medals, and pictures. The various sections will be sold in the following order:—Egyptian and other ancient bronzes, terra cotta, &c.; painted Greek vases—these alone will occupy four days; engraved gems and stones, statuettes in silver, jewels, and ancient glass; medals, ancient and modern; sculpture in marble, ivory, and wood; bronzes, faïences, enamels, arms, &c., of the middle ages, and renaissances; ancient curiosities of various kinds, European and oriental; ancient sculpture, tables, vases, &c.; modern paintings; and lastly, the works of the old masters, drawings, &c. Amateurs, and all connected with the fine arts, are looking forward to the Pourtalès sale with great interest.

Miscellaneous Sales.—Pictures and other works of art are fetching small amounts at the present moment in Paris. At a sale, consisting principally of works from the Chateau of Belfort, a holy family, attributed to Andrea del Sarte, the Virgin, with the infant Jesus on her knees, Saint Elizabeth, holding the young Saint John by the hand, opposite, and Joseph behind the Virgin, was withdrawn at 10,000 francs. "The Three Graces," and "Mademoiselle de la Vallière," by Pierre Miguard, formerly the property of Louis Philippe, a large picture, was purchased for the Troyes gallery for £100; a portrait, by Govaert Fluick, sold for £40; "Le Passage du bac," by Salomon Ruysdael, 960 francs (£38 8s.); "Pilgrims praying before a Chapel," by the elder Teniers, only fetched 245 francs (£9 16s.); and a group of peasants dancing before a farm, by the same, 411 francs (£16 8s. 10d.). The well-known "Girl with Dog," supposed to be by J. B. Grenze, fetched 354 francs (£14 3s. 4d.); a landscape, with animals, attributed to Cuyp, was withdrawn at 10,000 francs; a head of Cæsar, by Ary Scheffer, sold for only 150 francs (£6).

Church Decoration in Paris.—A sum equal to £11,584 has been devoted to the decorations of the new Church of St. Augustin. The interior of the cupola is to be illuminated with large figures, sixteen in number, of prophets, saints, and fathers of the church, surrounded by cherubim, on a blue ground, studded with golden stars; in the pendentives are to be painted the four evangelists, accompanied by angels; the vaultings of the side chapels are to be painted with six subjects from the lives of St. John, St. Peter, and St. Paul; these, with one or two minor commissions, amount to nearly £2,880. The stained glass, and three medallions beneath the porch, in distemper colours, enamelled, amount to £2,760. The sculpture includes a bas-relief, for the porch, of Christ and the twelve apostles; a marble statue of the Virgin Mary; more than twenty statues of the evangelists and saints, for the decoration of the façade of the building, with minor works in stone, and bronze figures for the doors—together, £5,944.

Monument to Counts Egmont and Horne.—On the seventy-fourth anniversary of the birth of King Leopold, a fine monument, by Fraikin, in memory of these victims of the ferocity of the Duke d'Albe, was uncovered in the Place of the Hotel de Ville, at Brussels, where they were beheaded in 1568. The Burgomaster had specially invited the attendance of the presidents and members of the societies of archers and crossbow-men, who still keep up the customs and oaths of the ancient guilds. These companies, in 1568, in spite of the despot who then ruled over the land, took upon themselves the honour of paying the last tribute of respect to the remains of the unhappy counts. It was right that their representatives should in 1864 have the honours of the inauguration of the expiatory monument. The pedestal has, with more than doubtful taste, been adapted to the purposes of a public fountain. It is true that the French have done the same in the case of Molière and others, and that we have, once at least, committed the like solecism, but a hundred such

precedents would not warrant such a violation of good taste and propriety.

Public Statues and Portrait Galleries.—The *Conseil-Général* of the Meuse has decided on creating, in the town of Bar-le-Duc, a gallery of portraits of the generals and marshals natives of the department, and the execution of the portraits has been confided to M. Gabriel Lefébure, a painter of history. It is hoped that other departments will follow so good an example, but that the list will be extended so as to include not only the military, but also literary, artistic, scientific, and other celebrities. Everybody can understand a portrait, and local *amour propre* alone would render such galleries popular, and aid the growth of a taste for art. A statue is to be erected at Villers-Bocage, near Caen, to the great self-made manufacturer Richard Lenoir, after whom one of the new Paris boulevards is named; the work is entrusted to M. Louis Rochet, the sculptor of the equestrian statue of William the Conquerer, so popular in Normandy, and it is to be finished next year, and inaugurated on Lenoir's centenary anniversary. The funds have been supplied by subscription amongst the inhabitants of the department of Calvados. The Minister of the Fine Arts has just presented the town of Abbeville with a magnificent marble bust of the poet Milleroy, who was a native of that place. The competition for the statue of M. Billault to be erected at Nantes, has failed, none of the designs having been considered satisfactory. Four of the competing artists have been invited to send in other models. It is whispered that the sum devoted to the purpose of the statue is so small that artists of known ability and standing declined to enter the list.

Artistic Benevolence.—A young painter of Paris having been struck with paralysis, a number of his brethren resolved to contribute each a picture or drawing to be sold for his benefit. The sale took place the other day, and realised 15,000 francs (£600). Four pictures, by M. Corot, fetched 2,080 francs; one by Daubigny, 375 francs; a Bonnat 340 francs, &c. Such an act of benevolence deserves to be recorded.

Sale of Objects of Vertu.—The collection of a well-known artist and amateur, the late M. Mathieu Meusnier, was sold in Paris last week, and exhibited the growing taste for old *faïence* and other productions of that class. A large rustic basin, by Bernard Palissy, sold for 600 francs; a curious circular dish, or salver of Pesaro ware, of the sixteenth century, bearing the inscription, "*Io ma Rechon an da Dio*," and decorated with a figure of a knight in armour, after the style of Albert Durer, 280 francs; two apothecaries' beakers, of Florence ware, 200 francs; a plate of Persian manufacture, 301 francs; a large vase, ornamented with flowers in relief, made at Marans, near La Rochelle, 470 francs; a large apothecary's beaker (*aignière*), of Nevers ware, 335 francs; a number of plates, jugs, basins, and other articles of Rouen manufacture, from 100 to 200 francs each; a small finger fountain, of the ware of the south of France, decorated with a view of Marseilles, 310 francs; a large covered cup, of the same kind of manufacture, 310 francs; an oval dish, of Moustiers make, 260 francs; a Burmese knife, the blade damascened, 860 francs; a carved boxwood comb, inlaid with ivory in colours, an Italian work of the fourteenth century, from the Debruges, 305 francs; an engraved key, French, of the sixteenth century, 325 francs; a Gothic lock, 420 francs; two large cups, in Venetian glass, ribbed blue and gold, 450 and 430 francs respectively. In the same sale, a marble statue of the Queen Marie Amelie, by M. Meusnier, after a small model by Pradier, sold for 2,100 francs (£84).

Convention between France and Switzerland, respecting Works of Art, &c.—A convention has been signed by the two governments, by which the literary and artistic productions of each country will be protected in the other. The convention is for twelve years from the 1st of January, 1866, and applies to printed matter, music, and works of art of all kinds.

Manufactures.

China Grass.—A very important paper has just appeared in the *Moniteur* of Paris, namely, a report approved by the Chamber of Commerce of Rouen, on the value of "China Grass as a Rival of Cotton." Previous announcements had appeared, in which great expectations were held out, and now we have the recorded opinion of experienced men, backed by the approval of the Chamber in the same sense. Passing over the enthusiastic expressions with which the report is introduced, we proceed to extract the mere facts as given in the report in question. In the first place the samples and products, on which the report is based, were exhibited for several weeks in the hall of the Chamber of Commerce at Rouen, and inspected by a large number of manufacturers of and beyond the district of which that town is the centre, a fact which the reporters quote as giving additional weight to their conclusions. "We made it our duty," says the report, "to collect the observations which reached us, and all may be summed up in this—that the specimens exhibited show excellent results corresponding exactly with the propositions of the Chamber, namely, to find a fibre capable of being manipulated without difficulty by means of the machinery used for spinning and weaving cotton, and which, moreover, can be dyed by the same processes as cotton; in short, everything tends to prove that a true substitute for cotton has been found." The first experiments having been made with small quantities of the grass, the Chamber purchased about six cwt., a third of which was operated on by the reporters or under their inspection, with the following results:—The grass was mixed with an equal quantity of Indian cotton, and worked in the ordinary manner; the carding alone presented some difficulties, but these the reporters believe may be very easily removed. No difficulty arose in the spinning. The yarns produced were Nos. 11 and 17, and these were employed in making a piece of *Cretonne*, military calico, 76 centimètres wide, and weighing 17 kilogrammes per 100 mètres, and four pieces of *Longotte*, or coarse cotton for printing, each measuring about 85 mètres, 93 centimètres in width, and weighing $16\frac{1}{2}$ kilogs. the 100 mètres. The mixture of China grass is said to give to the fabrics increased strength. The mixed yarn was rather less elastic than one of pure cotton, but this rigidity is regarded as an advantage as respects the duration of the fabric produced. As regards dyeing, eight cuttings of the mixed fabric were treated together with a similar number of pieces of pure cotton by the madder process, and the black, red, purple, violet, and orange are declared to be all that could be desired. Some doubt was felt about the "violet savonné," but the result is reported to be equal to that of the same colour obtained with pure Louisiana cotton, and even more brilliant. The deduction is that China grass has as much affinity for colours as the best cotton, that mixed with inferior cotton a "good middling" is obtained which dyes as well as the best average cottons, and that, consequently, there is a real economy in the employment of China-grass as regards taking colours. As respects elasticity and resistance the *Longottes* in the rough was 93 centimetres wide, and when bleached and dyed 80; 157 $\frac{2}{10}$ mètres of the former gave 161 $\frac{6}{10}$ of the latter, a result, equal it is said, to that of fabrics of Louisiana or Jumel cotton. The weight, too, bore the same proportions, namely, about one-eleventh less after bleaching and dyeing. Strips of the mixed cloth, ten centimètres long by five wide, were tried, for strength, by the dynamometric test, adopted by the Minister of War, and the result, as compared with similar strips of cotton unmixed, was as follows:—suspended the way of the warp, the mixed fabric exhibited rather less, while by the warp it had the advantage. As to the important element of price, the following are the facts set forth:—100lbs. of China grass yield 75 parts of yarn, 8 parts fit for paper-

making, and 17 parts waste, fit for manure. The cost of the fibre, as prepared for spinning, is put at 1fr. 57c. the kilogramme, or less than 7d. per lb., presenting an economy, as compared with Egyptian cotton at the present time, of nearly two shillings a pound! Such are the deductions to be drawn from the report in question. In addition to this, it must be added that the China grass will, it is said, grow with as little trouble in the south, centre, and west of France, as it does in Algeria, the West Indies, Senegal, India, and Guiana.

Coal in France.—In excavating for the Bourbonnais Railway, says the *Progrès de Lyon*, at a distance of two or three hundred yards above L'Arbresle, a small town about fifteen miles from Lyons, a seam of coal, which is said to be good, has been laid open. This accidental discovery is considered highly important, as indicating a coal deposit in this neighbourhood at no great distance from the soil. France is not wanting in coal, but it exists in many cases where no economical means of transport are yet established. No doubt good coal in the neighbourhood of such an important manufacturing place as Lyons would be a great boon, but all the world knows how deceptive are such discoveries as the one referred to; and we have not a geological map of France at hand to tell us whether there is anything new in the existence of coal in that quarter. Such facts, however, deserve to be noted, now that the import of English coal into France has grown so enormously.

New Thermograph.—M. Marey, of Paris, has invented a new registering thermometer. It is an adaptation of the air thermometer, and consists in a metal bulb attached to a tube of the same, which is but a fifth of a milimètre, or 0·0079 inches, in interior diameter; the receiver or indicator of temperature is a glass tube, bent into the form of a half-circle, one extremity being closed and attached to the circumference of a metallic wheel, resting on knife edges, and counterpoised. A mercurial index is introduced into the glass tube, which it divides into two chambers, one closed and the other open; and the metallic tube of the thermometer is passed through the mercury, into the closed chamber of the glass tube. On the axis of the wheel above mentioned is an arm, carrying a tracing point, which marks the variations on a registering cylinder. When the bulk is heated the air passes into the closed portion of the glass tube, forces back the mercury, and of course disturbs the equilibrium of the apparatus to an extent marked by the tracing point on the cylinder. The metal air tube is furnished with a valve near the bulb, so that the interior may be placed in communication with the outer air, in order to set the apparatus at zero. This is one of the instruments furnished to the scientific expedition for Mexico.

Sun Motor.—The other day a means of cooking by the aid of the sun, was proposed by M. Babinet, of the French Institute; another professor, M. Mouchof, suggests an application of the sun as a motive power. If, he says, a bell or cylindrical reservoir, of thin silver, blackened within, be filled half with water and half with air, and let the sun's rays fall upon it through two bell glasses placed over it, the air will expand and press upon the water. If a tube with a stop-cock be inserted near the lower part of the silver reservoir and curved upwards into a vertical position, the water upon the opening of the cock will leap to the height of ten mètres, and the fountain will be maintained as long as there is any water in the receiver, but the moment any body intervenes between the sun and the receiver, of course the action diminishes, and soon ceases entirely. M. Babinet thinks that such an application of the sun's power might be of advantage in Egypt, where, as he says, "the sun costs nothing."

Scotch Pig Iron.—The export of Scotch pig iron in the first ten months of 1864 amounted to 551,929 tons, against 539,430 tons in the corresponding period of 1863, 487,676 tons in the corresponding period of 1862, 497,706 tons in the corresponding period of 1861, and 466,325 tons in the corresponding period of 1860. Notwithstanding some depression in the exports in September and October, this year's exports show, as compared with 1863, an advance of 14,499 tons; as compared with 1862 an advance of 64,253 tons; as compared with 1861 an advance of 54,223 tons; and as compared with 1860 an advance of 85,604 tons.

Slate in New South Wales.—Some pieces of slate have been brought down to Sydney, from a quarry on the property of the Ophir Mining Company, about twenty-five miles beyond Bathurst. The samples have been pronounced by competent judges of the material to be of a very good quality, and to be well adapted for flagging, making cisterns, and various other purposes. It is also stated that the edge of the slate would cut in two-thirds of the time that the Welsh slate takes to cut, by hand process, while with the chisel it cuts free and is not likely to flake up. The slate exists in great quantity at Ophir, and the discovery promises to be of considerable importance.

Preserved Fish.—Messrs. Marshall and Co. have commenced a fishery and curing establishment at Lake Macquarie, New South Wales, where they are preparing to go extensively into the business of supplying the citizens and the colonists of the interior with fresh fish, in hermetically sealed tins, after the manner of those sent out from England. At present, the number of men employed can turn out half a ton per diem of 1-lb. and 2-lb. tins of fish. The fish—caught in the lake, or immediately outside its entrance from the sea—consist of whiting, flathead, bream, snapper, salmon-trout, mullet, and guardfish, forming as good an assortment as can possibly be desired.

Silk Culture in Australia.—Mr. F. G. Croft, of Penrith, has purchased about 20 acres of land, near his residence there, to be applied to the cultivation of silk. He has also purchased the whole of the fine lot of mulberry trees (*Morus multicaulis*), belonging to Mr. John Muston, at the North Shore, specimens of the leaves of which excited such favourable attention at a late meeting of the Acclimatisation Society of Sydney.

Paper Making.—The directors of the Australian Paper Company have purchased, through Messrs. Richardson and Wrench, a portion of the Collingwood Estate, near Liverpool, New South Wales, for the purpose of carrying on the manufacture of paper. The land consists of about 17 acres, and is considered to be admirably situated for that purpose, having an extensive frontage to the George's River, whence an abundant supply of fresh water can be obtained. It can also be connected by a siding with the railway.

Commerce.

Cultivation of Tea in India.—The recent history of the Indian tea trade furnishes us with an instance of speedy and marvellous development almost without an equal in any department of modern commerce. Forty years have not yet elapsed since Major Bruce first announced his discovery of the tea plant in Assam, and now Indian tea occupies an important place in our import tables, and seems likely eventually to prove one of the great staples of Eastern commerce. When, in 1834, the committee appointed by Lord William Bentinck to report on the best method of cultivating tea in India, with what now appears to us an amusing timidity, recommended the Government to make some experiments on the Himalayan range and on the Neilgherry hills, it was little imagined that in thirty years large tracts of land would be under cultivation, that capital would largely be withdrawn from other, and even European, channels, to be invested in tea plantations, and that so profitable would the speculation be, that persons of rank and position would be found devoting to it their time, their energies, and their fortune. Marvellous, however, as is the recent growth of our Indian tea trade, its ad-

vance has, fortunately, at the same time, been a steadily progressive one. For several years after Lord William Bentinck's committee had ceased to sit, the exports of tea from India were miserably small, and were, indeed, commercially speaking, scarcely perceptible when placed side by side with the gigantic trade of China. The sales of Assam teas in 1847 were only 144,161 lbs., while, three years later, they amounted to 253,427 lbs. The amount of tea exported from Calcutta to Great Britain in the year ending October, 1861, was 1,624,030 lbs.; in the year ending October, 1862, 1,949,856 lbs.; in the year ending October, 1863, 2,724,046 lbs.; while, in the present year, it has risen to 3,343,663 lbs. But if the past has produced such results, what hopes may we not entertain for the future! We believe that we are not exaggerating when we assert that the supply of Indian tea for 1865 will show an increase over the present year of something like 25 per cent.; and when we remember the quality of the commodity itself, and the increasing value which every day's experience attaches to it, we must hesitate before we set down as the dream of an enthusiast, the assertion sometimes made by those interested in the enterprise, that the day will yet come when India may rival even China, and when England may receive not only her cotton, but her tea from her great Eastern dependency. Whatever truth there may be in these anticipations, it is certain that the increase of tea plantations in India must, ere long, produce a marked alteration in the social condition of the population of many parts of that vast empire. A new class of Europeans will be, and, indeed, are already being introduced into India—persons with comparatively small capital, but who are attracted by the enormous profits which are now to be realised by the growth of tea. The advent of these English planters will necessarily introduce a fresh, and, we think, a more healthy element into Anglo-Indian Society, will furnish the stimulus to native industry which is so much required, and will establish centres from which civilization may ultimately permeate the masses of the native population. A few years ago it might have been necessary here to notice and reply to the assertions then so confidently made by some would-be authorities to the effect that the supply we annually receive from China is so nearly all that the British market demands, that no great increase in Indian, or even Chinese production, could ever be made a paying speculation. Exaggerated as it may appear to readers of the present day, it is nevertheless true that Parliament, not so many years ago, was assured, on very distinguished official authority, that it was "more than probable that tea has now reached the limit of consumption in England, and that any reduction of taxation would not augment the use of this innutritious leaf." We need scarcely say that the experience of every year which has elapsed since this rash prophecy was uttered, has shown, in a very decisive manner, the folly of such Parliamentary utterances; and it may now be confidently asserted that, so long as Indian tea preserves its present strength and flavour, there is not the slightest fear of a falling off in the demand, let the supply from China be what it may. Groundless, however, as were such fears, it cannot be denied that there are difficulties which may injuriously affect our great Indian experiment. The *Englishman* recently sounded an alarm which, we believe, will be echoed by those who are well acquainted with the recent course of affairs in the tea provinces of India. The planters in Assam and Cachar find themselves at the present time threatened with the same dangers which in other countries proved fatal to the tea experiment. The labour question is proving the great stumbling-block in the way of ultimate success. We have it on the authority of Sir Emerson Tennent, that the abortive experiment in Ceylon terminated as it did, not on account of any fault connected with the soil or climate, but solely from the want of skilled labour. Again, the failure of the interesting attempt to introduce tea cultivation into South Carolina, made by Dr. Smith, of Greenville, in 1850, must, we believe, be traced to the same all-important cause. Examples such as these ought to be sufficient to impress us with a sense of the gravity of the present crisis in India. Misunderstandings between the planters and the coolies seem unfortunately to be constant throughout the north-eastern provinces of India, and, so far have matters gone, that the *Englishman* declares that, if something be not done, tea planting in Assam will soon become a losing speculation, and, at last, die out altogether. Without at all endorsing this very sweeping statement, we do not hesitate to say that serious injury may, at the present moment, be inflicted on the material prosperity of India, if some satisfactory settlement of the differences between the contending parties be not speedily arrived at. In every country into which coolie labour has hitherto been introduced very great difficulty has been found in arranging and working out the details of the peculiar contract system which forms the basis of all coolie engagements. The Government authorities have, in most cases, only been too ready to let matters take their own course, and to allow masters and coolies to settle their differences between themselves as they best like. This species of *laissez-faire* policy has, unfortunately, been pursued in Assam and Cachar, and threatens disastrous results. The Indian Government, however, have it in their power to apply a remedy to this state of things, and, by a stringent system of regulations binding fairly and impartially both masters and coolies, to restore while it is yet possible a good understanding between them, and thus save from destruction a rapidly-advancing branch of industry, which, while it is certain to conduce to the material prosperity, will also, we believe, ultimately be found an efficient instrument in the promotion of the moral and social regeneration of our great Indian empire.

Colonies.

Sydney Fish. — A collection of young fish from Sydney, consisting of Murray cod and Mauritius carp, have been safely deposited in Berrima River. The collection had been obtained by the Rev. Dr. Hassall from the Acclimatisation Society of Sydney, and by him brought to Berrima, for the purpose of propagation in the Wing Ecarrible.

Ailanthus Silkworm.—The following remarks were made by Dr. Bennett, at an ordinary meeting of the Sydney Acclimatisation Society:—Dr. Bennett reported that the ailanthus silkworms recently hatched had all perished. A number had been produced from the eggs sent by Mrs. Devonport from Adelaide. From being unable to procure their natural food at this season of the year, attempts were made to feed them on young lettuce and mulberry leaves, as well as the foliage of the castor oil tree; they eat leaves of the lettuce and white, but not the castor oil tree leaves. The first worms were produced on the 28th June, and the last died on the 19th July. It would be desirable in future to take precautions to prevent their hatching until the season arrives when the ailanthus tree developes its foliage.

Cotton in Queensland.—The cotton plantations have been very uncertain in their returns, and in some instances the crops in low situations have been totally destroyed by floods during the picking season, while on others a very profitable yield has rewarded the growers. It is rumoured that one company, established for the purpose of cotton cultivation, are about to abandon the undertaking. With the experience of the past few years as a guide to future operations it is anticipated that the result of next season will finally settle the question as to the profits to be expected from cotton growing in this colony.

New Zealand.—Seat of Government.—A subject which naturally excites a considerable amount of interest is the proposed removal of the seat of government from

Auckland to a site in Cooks Strait. The decision, it is supposed, must lie between the three towns of Wellington, Picton, and Nelson, and the Commissioners who have been appointed to make the selection are expected to reach Nelson very shortly.

New Zealand Telegraph.—Arrangements are so far advanced for establishing telegraphic communication between all the provinces of these islands that there is no doubt but it will be in full operation next summer. The wire and other apparatus was expected to shortly arrive.

Obituary.

M. Guillaumin, Publisher, Paris.—This gentleman who was carried off with fearful suddenness by disease o the heart, at the age of 63, held a very eminent position in connection with political economy and cognate matters. He was the founder, or joint founder, of the *Journal des Economistes*, and also of the Political Economy Society, and the publisher of the admirable *Dictionnaire de Commerce*, of the *Annuaire de l'Economie Politique*, and of a large proportion of all the works published of late years on similar subjects. M. Guillaumin was a man of cultivated mind and peculiarly engaging manners, and was, probably, the last representative of a most worthy class of publishers. He resided at his place of business, in the Rue Richelieu, and his house was the resort of all the most eminent political and social economists of the day. He belonged to the liberal party, but he was more remarkable as the friend and patron of all who advocated the removal of restrictions on trade and the amelioration of the condition of the working classes. He was a man of the highest integrity in all his connections, and his death is a loss, not only to the party with which he was connected, but also to France. A large number of eminent men followed the remains to their last home, and M. Passy, formerly Minister of Finance, delivered a simple and most touching address over the tomb, recording the hope that the work which M. Guillaumin had commenced would not die with him. He leaves no successor, his family consisting only of two daughters, who were his beloved companions and fellow-labourers.

Publications Issued.

Practical Dietary, for Families, Schools, and the Labouring Classes. By Dr. Edward Smith, F.R.S. (*Walton and Maberley*).—Dr. Smith has been long known to the members of the Society of Arts as an authority on questions of diet, and received one of the Society's medals, in 1861, for papers read by him, and researches made into the influence of alcohols and tea. During the present year the subject of dietary was largely discussed, under his presidency, at the Physiological Section of the British Association, and to that may probably be attributed the publication of this practical work on dietary. There can be no doubt that a work which might be a safe guide to the different classes of the community was much needed—one which should be cheap, and, while written with scientific accuracy, should be simple and practical in its directions. No writer of the present day, probably, possesses more of the qualities needed for such an undertaking than Dr. Smith, and his authority will be generally accepted. The preface informs the reader that "the following work is intended to be a guide to heads of families and schools, in their efforts to properly nourish themselves and those committed to their care; and also to clergymen and other philanthropists who take an interest in the welfare of our labouring population. It is essentially practical and popular in its aim, and therefore contains directions rather than arguments, but at the same time it is based upon the most advanced state of the science, and, except in the exclusion of many technical terms, is scientific as well as popular. The unusual interest with which the subject of dietary is now regarded, both in a personal and philanthropic point of view, leads to the hope that the publication of this work is not inopportune, and the more so that the Government has lent the most effective aid in the collection of facts, on which it is in fact founded, as shown by the Reports of the Medical Officer of the Privy Council for the years 1862 and 1863, and the press has warmly advocated the importance of the subject. But to clergymen and medical men, more than to others, do the labouring classes look for advice; and much of the usefulness of this and similar works must depend upon their efforts. Ladies, also, may exert the most beneficial influence, and, with a view to aid such efforts, I have added in an appendix certain forms of handbills suited for distribution to the poor." The reader will concur with the author, when he adds that "it cannot be doubted that as dietary is a most necessary and powerful agent in the treatment of disease, so is the due supply of food a chief means of preventing disease and diminishing the burdens of the community. Hence the subject has as much interest to the statesman as to the physician;" and we feel assured that the work in question will be extensively read and do good service.

The Farm Homesteads of England. By J. Bailey Denton, M. Inst. C.E., F.G.S., Honorary Member of the Royal Agricultural Society of Hanover, and Engineer to the General Land Drainage and Improvement Company. (*Chapman and Hall.*) To farm successfully with defective and ill-arranged buildings is no more practicable than to manufacture profitably in scattered, inconvenient workshops, in place of one harmoniously-contrived, completely-fitted mill. No one who is at all acquainted with the farmsteads of Great Britain can fail to be struck with their want of adaptation to the purposes for which they are required. Not only do those which were erected in the last century fail to agree with our improved modes of husbandry, but there will be no exaggeration in saying that they were not suited even to the requirements of those for whom they were built. In former years such buildings might be characterised as a medley of hovels and sheds, thrown together without system. They wanted the merit of convenient arrangement as much as of architectural design. Up to a very recent date, a professional education was considered rather to unfit a man for this branch of art; and the landlord had recourse to local talent, of whatever order it might be. The provincial builder was usually entrusted with the preparation of the plans, in the same way that the blacksmith and wheelwright were looked to for the implements of tillage. He performed this duty with but little reference to the site or character of the farm, and generally upon examples afforded in the neighbourhood. In fact the plan, under the pencil of a parsimonious landlord, was apt to be so curtailed as to be seriously detrimental to the conduct of business; while under that of a landlord used to yield to the whim of a tenant, it was expanded beyond desirable limits. There was not, what we have now arrived at under the stimulation of an imperious necessity, any collection of well-recognised axioms. In quarters where Farm Architecture has ceased to be treated as a mere matter of taste, and where the prosperity of the tenant has been shown to depend in a great measure upon the sufficiency and competence of the accommodation afforded by the homestead, its buildings have been designed with the requisite fitness for the farm, and constructed with a view to durability. Agriculture, in fact, has most properly come to be regarded as a manufacture; and the benefits arising from a perfect adaptation of the farm buildings to the various operations conducted within them are now generally admitted. Much careful attention, in different parts of the country, has of late been given to this subject, and several works have been published, setting forth plans and data of a very valuable description. These, however, have generally contained only the

design of a single architect, and have mostly been issued to create or sustain professional repute. This course might have been followed in the present instance, but the editor has preferred to collect a series of the plans of many different designers, but adapted to the requirements of modern husbandry under all its phases of breeding, feeding, and dairying, in various localities and climates; being strongly impressed with the fact that what the landowner, farmer, and architect now require is an exposition of the leading principles of this branch of constructive art, as they are illustrated by accomplished results on the farms of our foremost agriculturists. Hence the desirability of a work like the present, which collects and records valuable precedents, and professes to give the present state of our knowledge on the subject. The editor has accordingly represented twenty-four specimens of homesteads, the plans being accompanied with descriptive matter not only concerning the buildings, but also the farms upon which they are situated, and the modes of husbandry to which they apply. They embrace covered homesteads, and homesteads distinguished by special accommodation for the rearing and feeding of all descriptions of stock; care having been taken to select examples from farms of various sizes as well as from those characteristic of different localities, in order that persons concerned may study precedents analogous to their particular requirements. It has been found desirable to combine with these plans, drawings of farm-houses and labourers' cottages, together with an illustrated digest of the principles of arrangement and construction which govern the details.

Notes.

Poultry Show in Paris.—Five of the *salons* in the *Palais de l'Industrie*, the sides of which were covered a few months since with the productions of the artists of all nations, presented an extraordinary appearance on the 19th, 20th, and 21st instant. In place of history, battles, landscapes, and portraits, were collected the inanimate bodies of fowls, turkeys, geese, and ducks. The exhibition was a great success: there were more than five hundred contributors, and between two and three hundred specimens of poultry of one kind and another. Nineteen departments were represented. The arrangements were admirable; sloping tables were placed around, and double stands of the same kind in the centre of each room. These were covered with blue paper, upon which the poultry was laid out, with ample space on all sides, the various lots, each consisting of four specimens, being separated by fillets of wood, painted red, so that every article exhibited could be seen perfectly. On the walls were neatly-painted devices, containing the names of the classes and localities of production, and hung about with laurel, intermingled and enlivened by a few coloured ribbons. The first day was devoted to arrangement; the second, till one o'clock, to the decisions of the jury; after which the public was admitted at a charge of half a franc; and the third to exhibition and sale of the articles. The jury was composed of Comte Léopold Le Hon, President, representative in the Corps Legislatif of the department of Ain, famous for its poultry; two Inspectors-General of Agriculture, four farmers, and four dealers in poultry. The sum of four thousand francs was devoted to prizes, besides medals in gold, silver, and bronze. The grand prize consisted of a large gold medal and a thousand francs. The awards were marked by means of oval cast-iron tablets, painted blue, with the raised letters picked out in gold colour. The fowls were divided into five categories—birds of the races of La Bresse, of La Flèche, of Houdan, of Normandy, and miscellaneous. The first of these was by far the most numerous, as the poultry is the most esteemed. One gold, one silver, and a number of bronze medals and honourable mentions were awarded in each class, and the grand Prix d'honneur was awarded to M. Gorgondet, of Treffort, in the department of the Aix, for four pullets of the race of La Bresse. The other five classes consisted of turkeys, ducks, geese, pigeons, Guinea fowls, and other poultry. The department of Seine-et-Oise carried off the first and second prizes for turkeys, that of Orne the gold medal for geese, and Rouen the same for ducks. The fowls of La Bresse were not so remarkable for size as for smallness of bone and plumpness; and the manner in which they are prepared for market is quite artistic. Some of the geese were truly gigantic; but the turkeys would not have borne comparison perhaps with those of Leadenhall market. The sale was very brisk, and the names of almost every celebrated gastronomic establishment in Paris were to be seen on tickets in all directions. Forty and fifty francs were asked and easily obtained for prize geese and turkeys; and fowls that had obtained medals were marked in the morning after the exhibition as high, if not higher, than thirty-six francs each. Poultry is an article of great importance in France, and the rearing of fowls in La Bresse, Burgundy, is one of the staple occupations of the locality; but it is not carried on in large establishments, experience proving that the collection of large numbers of poultry in one place invariably gives rise to epidemics amongst them. The Bresse race is not, however, so pure as some others, the delicacy of the meat and the rapidity of the fattening being supposed to depend principally on soil and the mode of feeding. The Bresse pullet can be fattened at the age of three months, while those of other localities cannot be got ready for market till after the fifth or sixth month. The modes of rearing poultry differ in different localities. At La Bresse a pullet of three months is worth about two francs, and the fattening occupies from fifteen to thirty days. To produce what is called a fat pullet takes about five gallons of meal, made from maize and black wheat. This is mixed with curdled milk and given to the poultry in balls; the greater part are, however, only half fattened. A fine fat pullet sells for six to ten francs; an ordinary one for three to five francs at the local market of Bourg. The poultry of the Flèche race is fed in the department of the Sarthe, on barley and black wheat meal mixed in the same way with milk. Four young cocks, for which a prize was given, averaged eleven pounds (English) each, and were valued at 20s. to 24s. each.

South Kensington Museum "Boxing Days."—Since the opening, in 1857, the numbers each year have been as follows:—1857, 5,918; 1858, 9,683; 1859, 8,651; 1860, 5,957; 1861, 9,694; 1862, 5,962; 1863, 8,382. The annual average has thus been 7,750, but on Monday last the numbers exceeded 12,890.

Warming of Railway Carriages.—It is reported that experiments in warming carriages by steam have been made on the Royal Eastern line of Prussia, between Bromberg and Thorn, and with complete success. Previously the carriages reserved for ladies were warmed by means of hot sand or stones, but both were found insufficient or objectionable. In the new arrangement, a special boiler is placed in a luggage van, and the steam is conveyed, by means of junction pipes, into wooden cylinders, placed in all the carriages. Each compartment is provided with a small lever, which enables the travellers to regulate the temperature according to their feelings. During the experiments in question the heat was maintained at 22° Reaumur.

French Academy of Inscriptions and Belles Lettres.—Mr. Edward William Lane, of London, has just been elected a corresponding member of this branch of the French Institute, in the place of Baron de Witte, promoted to the rank of Foreign Associate.

German Pictures.—At the sale of the library of the late M. Favart, a copy of Lebrun's Gallery of Flemish, Dutch, and German Painters, sold for more than £10. Gilray's caricatures, a rare copy, with the 45 suppressed plates, fetched £8 odd. A curious collection of nearly 100 sketches on vellum and paper, representing Italian and German

costumes, by various artists of the latter half of the 16th and the early part of the 17th century, was sold for £8.

Naphtha Springs.—The peninsula of Lenkoran (Asiatic Russia) contains numerous springs of naphtha. No less than 109 are now worked, and yielding annually about 4,000 tons of naphtha, similar to that brought from America. There are also many springs of the kind in the Isle of Taman.

Proposed Potteries Industrial Exhibition.—It was suggested at a recent meeting of the committee of the Hanley Mechanics' Institution that an exhibition of the productions of the workmen in that district should be held. The proposal was well received, and a committee was appointed to make the necessary preliminaries. Arrangements have been so far made that it is considered probable that the exhibition will be held in the month of April, and from the active way in which the committee are entering into the undertaking it is likely to prove very successful.

Scholastic Registration.—The General Committee for promoting this object, encouraged by the success which has attended the movement in favour of Scholastic Registration, has resolved to convene a public meeting of schoolmasters, and others interested in education, to consider the best means of bringing the question before the Legislature and the public. The meeting will be held, by permission of the Council of the Society of Arts, on Thursday, 5th January, at 2 p.m., at the rooms of the Society, John-street, Adelphi. The Hon. Secretary will read a report of the progress of the movement to this date, and will give an outline of the Medical Act, which has suggested the proposed Act, on a somewhat analogous plan, for the Registration of Schoolmasters and Teachers. Several gentlemen of influence will take part in the meeting; and it is hoped that all promoters of educational reform will endeavour to attend, and co-operate with those whose object is to obtain for the public some protection against incompetent educators, and for the profession the position to which its character and importance entitle it.

Public Works in Paris.—The Prefect of the Seine has just published his annual financial report, and from this and other official sources we learn the cost of the works carried on in Paris during the last twelve years. The amount expended on demolitions, reconstructions, and embellishments, that is to say, on extraordinary, as distinguished from the works of the city, is given as 900,666,627 francs, or, in round numbers, about three millions sterling on an average per annum. Of this total the city of Paris has supplied rather more than two-thirds, and the State less than a tenth; the balance being derived from a resale of land and other miscellaneous sources. The 900 and odd millions have been divided amongst various works in the following proportion:—Nearly 33 millions for charitable objects; religious edifices, upwards of 32 millions; municipal buildings and schools, more than 64 millions; the great market, nearly 12 millions; bridges and roads, nearly 50 millions; formation of new boulevards and streets, 590½ millions; extension of Paris to the fortifications, including the removal of the Octroi wall and gates, and construction of the new barriers, nearly 130 millions of francs. In 1859 Paris was lighted by 14,911 gas lamps, and the banlieue by 2,812 gas and 750 oil, making a total of 18,939 lights, now increased to 30,395. The great system of drainage is approaching its conclusion; and in the month of May next Paris will have its new river in the canal which is being constructed to bring the waters of the Dhuis to the capital; artesian wells have been sunk; large reservoirs for the supply of the city have been formed in the outskirts; half the theatres have been rebuilt; the parks and promenades have been planted and improved; many public squares have been planted and thrown open to the public; new roads and streets have been formed, and many old ones widened, ventilated, and otherwise improved. This is certainly a vast amount of work to have been done in a dozen years, even under the extraordinary circumstances of the case; and it is astonishing that even the immense sum given in the report in question should have been half sufficient for what has been performed. One of the most important, nay, the most important result attributed to the improved condition of the city is the reduction of the rate of morality. In 1836, when the first quinquennial census was made in France upon the present system, the deaths were 2·78 per cent., or in the proportion of one in 36 inhabitants annually; in 1841 and 1846 the rate was nearly the same; but in 1856 it had fallen to 1 in 39; and it now stated at about 1 in 40. With respect to future works a commission has been appointed to draw up a general programme based on the following questions:—What buildings require re-building or enlargement to meet the necessities of the public service? What will be the expence of each? and What is the degree of urgency of each, and in what order should they be undertaken?

Steam Omnibus.—Nantes was the birth-place of the omnibus, and to this day the original arrangement of a conductress swinging in a basket at the back is adhered to, and having been the first to supply horse flesh to the million, that busy town seems bent upon setting aside her own former pet in favour of a new one. A steam locomotive, with passenger carriages attached, has for some time attracted great attention in that place, and the accounts published are highly laudatory. The new conveyance is the invention of M. Lotz, an engineer of Nantes, and it has obtained the attention of the authorities. A short time since, at the request of the Prefect of the Department, the locomotive, with a *char-à-bancs* and an omnibus attached, was driven into the yard of the prefecture, where, it is said, it was turned round and moved about with singular facility. The Prefect and some few other gentlemen then entered one of the carriages, and the train was conducted through the streets of the town and towards the Paris road. At first the pace was that of an ordinary trotting horse, but when outside the town this was increased to more than sixteen kilometres—nine and a-half miles an hour. It is reported that the mode of attachment adopted by M. Lotz is so good that the locomotive, with two carriages in its train, turns in a circle of about thirty feet in diameter. If these reports be not a little too highly coloured, M. Lotz has been more successful than other engineers who have attempted the application of steam for ordinary traffic. And even supposing the triumph to be achieved, the question of cost still remains to be answered.

Electro-Magnetic Locomotive.—At a meeting of the Scientific Society of the Department of the Seine-et-Oise, held at Versailles a few days since, a model of an electro-magnetic locomotive was exhibited and explained by its inventors, MM. Bellet and De Rouvre. This new engine is intended to run on rails, and the arrangement of its parts is somewhat curious. The driving power is given to a single pair of wheels situated at the rear of the engine, as in the Crampton engines. A number of magnets are arranged radially on these wheels, their poles towards the circumference; the voltaic current is conducted from the centre of each wheel to all the magnets in succession, and these latter act directly on the iron rail itself. The inventors claim for their engine the great advantage of excessive simplicity, and moreover, that as the magnets act directly on the rails, there is a constant amount of adherence, which does away with the necessity of weight to ensure safety even with the highest speed possible. The inventors seem to have specially in view the postal and telegraphic service. They say:—"This machine may be employed to carry letters and parcels in the interior of towns at the rate of twelve or fourteen miles an hour, on subterranean railroads, connecting the principal post-offices; and as the locomotives for such service would be very small, the works would be comparatively inexpensive. Larger machines might run on the existing railroads, and convey despatches at the rate of a hundred and twenty miles an hour." The machine is

ingenious, and doubtless works well in a model, but it remains to be seen whether it would be practical on a larger scale.

The Atlantic Cable.—The entire length of the Atlantic telegraph will be 2,300 miles. There are seven copper wires to form the conductor, so that there are 16,000 miles of copper wire. Every portion of this wire is subjected to electrical tests to ascertain its quality for conduction before it is allowed to be worked up. The next stage is to coat these with eight successive coats of the insulating material, equal to an aggregate length of 18,400 miles. This core is next covered with jute wound round it from ten strands, making 23,000 miles of jute yarn. Then comes the outer coating formed of the ten covered iron wires. The iron wire itself is 23,000 miles in length, and each wire is covered separately with five strands of tarred hemp, 135,000 miles of the latter being required, making together an aggregate length of material employed of 215,000 miles.

Chinese and Japanese Works.—A remarkable sale of Chinese and Japanese curiosities, stated to be the property of Mr. Marks, of London, took place in Paris on the 29th November. Two large garden stools, or table bearers, in incised enamel work, ornamented with flowers on a blue ground, fetched £248. A fine four-sided vase, of the same character, decorated with landscapes, kiosts, and scenes of industry, was sold for more than £68. A rock crystal ball, about 16 and 17 inches in circumference, realized upwards of £52. Five pieces of Chinese enamelled ware, ornamented with flowers and birds, the vases being about 13 inches high, sold for £108. Two vases in old Japan porcelain, 33 inches high, decorated with landscapes and flowers, in blue, red, and gold, realized nearly £59. A vase of old Chinese porcelain, decorated with agricultural scenes, rather more than 13 inches high, fetched nearly £44. And two vases of the same manufacture, with cameos of figures, animals, and flowers, in blue on a white ground, £60. The day's sale produced 42,868 francs (£1,715 nearly).

To Correspondents.

Erratum.—Page 95 in the last *Journal*, in Mr. Jones's speech, for "Loriners" read "Turners."

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Entomological, 7.
Tues.... Pathological, 8. Annual Meeting.
Photographic, 8.
Anthropological, 4. Annual Meeting.
Royal Inst., 3. Prof. Frankland, "On the Chemistry of a Coal." (Juvenile Lectures.)
Wed. ...Pharmaceutical, 8.
R. Society of Literature, 8½.
Thurs...Royal Inst., 3. Prof. Frankland, "On the Chemistry of a Coal." (Juvenile Lectures.)
Fri.......Philological, 8.
Sat.......Royal Inst., 3. Prof. Frankland, "On the Chemistry of a Coal." (Juvenile Lectures.)

Patents.

From Commissioners of Patents Journal, December 23rd.

Grants of Provisional Protection.

Aeriform fluids, &c., obtaining motive power from—3044—M. P. W. Boulton.
Artificial fuel, compounding by agglomeration—2920—G. M. de Bayelt and J. E. Vigoulete.
Beer engines, works and cases of—2869—R. G. Grimes.
Belt and sanatory apparatus—3034—W. E. Gedge.
Bridges, construction of—3069—A. J. Sedley.
Casks—3002—C. Smith and W. Fletcher.
Coal and coke, separating sulphur from—2998—C. Binks.
Coals, &c., revolving retorts for producing oil from—3020—J. G. Winter.
Cotton, ginning or cleaning—2982—E. W. Otway.
Cotton pieces in the gray, apparatus for finishing—2933—J. Eastwood and W. Wadsworth.
Electric fire buttons and indicators—2997—J. Sax.
Felt, manufacture of—3046—R. Richardson.
Fibrous substances, apparatus for preparing, &c.—3053—M. J. Roberts.
Fire-arms, breech-loading—3001—T. Wilson.
Fire-arms, &c.—2892—J. G. Tongue.
Gases, apparatus for the production of—3018—C. W. Siemens.
Gunpowder, &c., prevention of the accidental explosion of—3017—J. G. Ulrich.
Hair brush, mechanical—2999—J. Neat.
Hand stamps—3028—W. E. Newton.
Hollow ware, moulds for casting—3097—J. Crowley.
Human hair, apparatus used when brushing—3085—A. Brittlebank.
Iron, manufacture of—3071—J. Vaughan.
Jacquard machine—3105—J. and J. Leeming, and J. Lister.
Japanned ware and furniture, decoration of—3054—A. Smith.
Lighthouses, &c., apparatus for sounding bells on—3057—C. Oliver.
Meat, &c., rooms and places for curing and preserving—2995—T. Harris.
Metal tubes, &c., solid and seamless—3091—J. Barnsley.
Neck collars—2967—S. S. Maurice.
Ornamental fabrics, production of—3012—J. K. Crawford.
Photo-sculpture—3107—A. F. J. Claudet.
Pumps—3021—H. Wilson.
Railway carriages, apparatus for enabling the guard to keep all the doors closed until the train is to a stand-still—3067—J. Holly.
Railway carriages, locking and unlocking the doors of—3024—R. Shaw.
Railways and tramways—3081—W. A. Adams.
Ruche for chenille and upholsterer's trimmings—3036—G. Dixon.
Ships, propellers for—2996—J. Taylor.
Signals, railway carriage and passenger—3016—J. W. Proffitt.
Silver, &c., coating iron and steel with—3095—J. B. Thompson.
Sliding gasaliers, &c.—3022—R. Tye.
Smoke consuming apparatus—3032—A. Blampoil.
Sound, apparatus for rendering inaudible—3000—F. C. Rein.
Spring mattresses, folding—3004—S. P. Kittle.
Steam boilers—3052—W. Husband and J. Quick, jun.
Stones, &c., apparatus for breaking—3038—T. Archer, jun.
Submarine explosives, conveying and exploding—2582—W. M. Ryer.
Textile fabrics, manufacture of—3008—W. Pollock.
Throstle spinning, &c., apparatus for effecting the drag in—3087—A. Pemberton and J. Ford.
Travelling, combined stretcher, bed, cushion, and wrapper for—3040—A. H. Robinson.
Vegetable substances, obtaining extracts from—3101—P. F. Lunde.
Weights, raising and lowering—2993—J. Soper.
Wet gas meters—3059—E. Myers.

Invention with Complete Specification Filed.

Straw hats, &c., shaping and pressing—3099—G. W. Belding and D. E. Holman.

From Commissioners of Patents Journal, December 27th.

Patents Sealed.

1605. J. M. Johnson & J. Buckley.
1616. T. Thomson and J. Murray.
1624. C. Frielinhgaus.
1627. M. L. J. Lavater and E. W. Niblett.
1628. R. A. Brooman.
1632. A. Kimball.
1634. W. Brookes.
1637. D. Gallafent.
1638. F. L. H. Danchell.
1639. T. Day, sen., & T. Day, jun.
1644. E. T. St. L. MacGwire.
1649. A. Thomas.
1653. N. Jarvie and W. Miller.
1658. W. Jackson, T. Glaholm, and S. S. Robson.
1660. A. S. Tomkins.
1679. A. B. Baron Von Rathen.
1744. V. Pean and A. F. Le Gros.
1746. J. Lewis.
1794. W. McI. Cranston.
1795. F. Seebohm.
1823. A. V. Newton.
1848. J. C. Ramsden.
1849. J. Jeffreys.
1873. W. Anderson.
1930. P. G. B. Westmacott.
1949. A. H. A. Pflughaupt.
1970. J. H. Johnson.
2022. J. Hodgart.
2046. G. Coles, J. A. Jaques, and J. A. Fanshawe.
2406. J. T. Pendlebury.
2462. H. Nelson.
2507. G. Coles, J. A. Jaques, and J. A. Fanshawe.
2664. E. J. W. Parnacott.
2689. B. Scalé.
2714. E. L. S. Benzon.

Patents on which the Stamp Duty of £50 has been Paid.

3212. W. Kempe.
3271. W. E. Newton.
15. J. Howard and E. T. Bousfield.
22. G. Jeffries.
3214. J. H. Johnson.
3216. C. Smith.
3217. J. Rosindell.
3218. C. Smith.
3227. G. H. Birkbeck.
3249. E. Lord.
3251. M. Henry.

Patents on which the Stamp Duty of £100 has been Paid.

3136. W. Basford.
3177. I. Holden.
3183. E. Gomez and W. Mills.
3150. A. F. Kynaston.
3188. T. Booth.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, JANUARY 6, 1865. [No. 633. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

Jan. 18.—"On the Best Mode of Applying Power to Propel Trains, on the Metropolitan and other Railways, having Frequent Stations." By Peter W. Barlow, Esq., F.R.S.

Jan. 25.—"On the Best System for Extinguishing Fires in London." By Fredk. Young, Esq.

Feb. 1.—"On London Sewage, from the Agricultural Point of View." By J. Chalmers Morton, Esq.

Cantor Lectures.

"On the Reproduction of Natural Forms by Art and Manufacture." By B. Waterhouse Hawkins, Esq., F.G.S., F.L.S.

Mr. Hawkins will resume his Course, on Monday Evenings, as follows:—

Jan. 16th, 1865.—Lecture III.—On the varieties of artistic treatment of the forms of animal and vegetable life—pictorial representation; conventional ornamental, allegorical, and symbolic combinations of animal forms.

Jan. 23rd.—Lecture IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

Jan. 30th.—Lecture V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra-Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. A set of tickets for this purpose has been sent to every member.

Prizes to Art-Workmen.

The following is a Catalogue of the works sent in competition:—

First Division.

Works Executed from prescribed Designs.

No. 1. Carving in Stone of Boy and Dolphin. By "Lennox." Price £18.
2. Ditto in Marble. By "S." Price £15.
3. Ditto in Stone. By George H. Ives.
4. Ditto in Marble. By John Willis, 20, Elizabeth-street South, Pimlico, S.W. Price £15.
5. Carving in Wood of Chair-back. By James Stuart, 7, Pancras-square, N.W. Price £10.
6. Carving in Stone, after a Gothic Bracket. By W. Weaver, at R. Boulton's, Sculptor, Worcester.
7. Ditto in Stone. By "∽." Price £8.
8. Ditto in Stone. By "Leon." Price £8.
9. Carving in Wood of an Inkstand. By. W. H. Baylis, 69, Judd-street, W.C. Price £50.
10. Carving in Wood of a Harp-head. By T. E. Mayle, 17, James-street, Camberwell New-road, S. Price (completed) £15 10s.
11. Raphael's Three Graces, Repoussé Work in Metal. By W. Holliday, 14, Nailour-street, Islington, N. Price £16.
12. Ditto. By E. Beresford, 7, Chapel-street, Pentonville-road, N. Price £10.
13. Ditto. By C. Jacquard, 1, St. George's-road, New Kent-road, S.E. Price £6.
14. Ditto. By Thomas Bayley, Rann-street, Ladywood, Birmingham.
15. Repoussé Work in Metal, after a Flemish Salver. By Septimus Beresford, 29, Myddelton-street, E.C. Price £8 8s.
16. Ditto. By W. Ash, 54, Wych-street, W.C. Price (completed) £7 7s.
17. Ditto. By H. R. Batchelor, 149, St. John's-street-road, E.C. Price £18.
18. Hammered Work in Iron, after a Pediment of a Gate; designed for use as a bracket. By W. Letheren, Lansdown Iron Works, Cheltenham. Price £1 15s.
19. Ditto. By T. Winstanley, 10, Arthur-street, New Oxford-street, W.
20. Ditto in brass of the same. By J. Z.
21. Child sleeping, carved in Ivory. By J. W. Bentley, 22, Sherwood-street, Golden-square, W. Price £20.
22. Ditto. By John Richards.

23. Chasing in Bronze of "Clytie." By T. Nichols, 4, Everilda-street, Hemingford-road, N. Price £15.
24. Ornament chased in Bronze. By R. Orpwood, 2, Richmond-road, Park-road, Islington, N. Price £15.
25. Ditto. By R. E. Barrett, 26, Harrison-street, Gray's Inn-road, W.C. Price £15.
26. Ditto. By R. Reynolds, 15, Oak-village, Kentish Town, N.W. Price £12 12s.
27. Ditto. By A. Barrett, 26, Harrison-street, Gray's-inn-road, W.C.
28. Ditto. By S. R. Meek, 26, Harrison-street, Gray's-inn-road, W.C. Price £15.
29. Ditto. By V. F. Howe, 23, Berners-street, W. Price £10.
30. Ditto. By H. J. Hatfield, 16, Alfred-street, Tottenham-court-road, W. Price £10 10s.
31. Ditto. By H. R. Batchelor, jun., 149, St. John-street-road, E.C. Price £10.
33. Ditto. By S. Dawtry, 2, Walker-street, Infirmary-road, Sheffield.
34. Engraving on Silver of an Arabesque, by Lucas Van Leyden. By Gilles Mackenzie, 12, Tudor-street, Sheffield. Price £6.
35. Ditto on Copper. By G. S. Berry, 26, Warwick-street, Regent-street, W. Price £2 10s.
36. Painting on Porcelain of the Two Children in Raphael's Cartoon of "Lystra." By X. Designed for a door-plate. Price for the set of two plates and handles, £10.
37. Ditto. A Plate. By T. R. Price £10.
38. Ditto. A Plate. By H. Price £10.
39. Ditto. By Joseph B. Evans, South-street, Mount Pleasant, Fenton Potteries.
40. Ditto. By W. J. Goode, South Audley-street, W.
41. Ditto. By E. E. Dunn, Milner-street, Bethesda-street, Hanley, Potteries. Price £5.
42. Ditto. By Stephen Lawton, Bucknell Old-road, Hanley, Potteries.
43. Painting on Porcelain of an Arabesque, by Lucas Van Leyden. By Joseph B. Evans, South-street, Mount Pleasant, Fenton, Potteries. Price £10 10s.
44. Ditto. By George Griffiths, 22, Castle-street, Newcastle-under-Lyne.
45. Decorative painting. By Robert Yarrow, 67, Herbert-street, New North-road, N. Price £3 10s.
46. Ditto. By John Henk, George-street, Stoke-upon-Trent. Price £2.
47. Inlay in Metal. By E. A. Millward, 35, Little Clarendon-street, Somers-town, N.W.
48. Cameo cutting. Human Head. By James Ronca, 156, King's-road, Chelsea, S.W. Price £8.
49. Ditto. By "H. S." Price £12 12s.
50. Ditto "St. George and Dragon." By James Ronca, 156, King's-road, Chelsea, S.W. Price £8.
51. Wall Mosaics. Human Head, after *Bertini*, of Milan. By "Nemo."
52. Ditto. By the same.
53. Ditto. By J. H. Stevens, Lambeth Glass Works, Carlisle-street, S. Price £25.
54. Ditto. By Samuel Cooper, Longfield-place, Hartshill, Stoke-on-Trent. Price £10.
55. Gem Engraving. Human Head. By E. H. Renton, 34, Percy-street, Bedford-square, W.C.
56. Ditto. By John Wilson, 14, Leicester-place, W.C.
57. Ditto. By A. Warner, 18, Newman-street, W.
58. Ditto. Full-length Figure. By John Wilson, 14, Leicester-place, W.C.
59. Die Sinking. Head of Prince Consort. By Henry Allen, Franchise-street, Birchfield, near Birmingham.
60. Ditto. By John Parkes, Nursery-lane, Harbourn, near Birmingham.
61. Ditto. By John Hatchett, 5, Glo'ster-terrace, Kennington-park, S.
62. Ditto. By George T. Morgan, Regent-place, Wheeler-street, Lovells, Birmingham. Price £2.
63. Ditto. By W. A. Walker, 14, Montpelier-place, Brompton, S.W. Price £10.
64. Bookbinding after an Italian Specimen. By Louis Genth, 15, Broad-court, Bow-street, W.C. Price £8 8s.

Second Division (Wood-Carving).

Works Executed Without Prescribed Designs.

Section A.

Human figure in alto or bas relief. Animals or natural foliage may be used as accessories.

67. "Spring"; a Child's Head. By Mark Rogers, 111, Tachbrook-street, S.W. Price £10.
71. Bas-relief, in rosewood. By W. M. Holmes, 101, Dean-street, Soho, W. Price £2 15s.
72. Ditto. ditto. By the same. Price £2 15s.
77. Female Figure, in Oak. By Charles Liddle, 72, Pancras-square, N.W. Price £30.
78. "Hope for the Future." By T. W. Wallis, Louth. Price £31 10s.
83. "Repose." By E. Brew, 73, Sankey-street, Warrington. Price £5.
84. "Caractacus." By G. R.
85. Nymph and Loves. By G. F. Bridge, 3, Vincent-square, S.W. Price £7 7s.
86. "Morning." By same. Price £1 10s.
88. Door for an Ebony Cabinet. By E. Glancy, Rose-cottage, Alexandra-terrace, King's-road, S.W. Price £18.
89. John and the Mother of Christ. By J. W. Gould, 33, Bayham-place, Camden-town, N.W.
91. Cain preparing his sacrifice. By James Griffiths, 8, Addington-place, York-road, S. Price £20.

Section B.

Animal or still-life. Fruit, flowers, or natural foliage may be used as accessories.

66. Chimney Piece. By Miss Maude, care of F. H. Simpson, Esq., 34, Fore-street, E.C. Price £31 10s.
69. Envelope Case and Blotting Book. Walnut Wood. By T. Hewitson, 5, Hatton-garden, E.C. Price £16 16s.
74 and 75. Panels for a Sideboard or Cabinet. Walnut Wood. By W. J. Gibson, 94, Star-street, Edgeware-road, W. Price £14 the pair.
79. Wagtail and Fly. By T. W. Wallis, Louth. Price £21.
81. Panel of Flowers and Birds. By "*"

Section C.

Natural foliage, fruit, or flowers, or conventional ornament in which grotesque figures or animals may form accessories, preference being given where the work is of an applied character for ordinary decorative purposes, as representing commercial value.

65. Portion of Frieze. By George Murray, 6, Claremont-place, Henderson-row, Edinburgh. Price £14.
68. Vase, carved in Boxwood. By John Manhood, 37, Berwick-street, Pimlico, S.W.
70. Envelope Case and Blotting Book. Sycamore. By T. Hewitson, 5, Hatton-garden, E.C. Price £10 10s.
73. Tripod Stand. By W. M. Holmes, 101, Dean-street, Soho, W. Price £12.
76. Pair of carved frames. By George Bull, 8, Chalton-street, Euston-square, N.W. Price £14 the pair.

80. A Fragment of Autumn. By T. W. Wallis, Louth. Price £7.
82. Fruit panel. Walnut wood. By W. Taylor, 21, Newman-street, W. Price £6 6s.
90. Panel with Double Festoon, and three drops of carved flowers. By George Lock, 26, Albert-street, Camden-town, N.W. Price £50.
92. Frieze. By T. R. Smith, 7, Clarence-gardens, Regent's-park, N.W. Price (completed) £8.

HUMAN FIGURE IN RELIEF.

93. The Temptation. By Gerrard Robinson, 14, Duke-street, Manchester-square, W. Price £30.
94. Garibaldi. By the same. Price £16.
95. Hunter. By the same. Price £16.
96. Knife Grinder. By the same. Price £15.
97. Shakespeare. By the same. Price £16.
98. The Barber. By the same. Price £16.

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87. Sleeping Child, carved in alabaster. By S. F. Bridge, 3, Vincent-square, S.W. Price £5 5s.

Proceedings of the Society.

ART-WORKMANSHIP COMPETITION.

A meeting was held on Monday evening, the 2nd of January, at which the exhibitors and their friends were specially invited to attend. At eight o'clock the chair was taken by WM. HAWES, Esq., who, in opening the meeting, said—

The object which the Council had in view in calling together the present meeting was to confer with the workmen themselves upon the system of Art-Workmanship competitions inaugurated by this Society, and to receive suggestions for carrying them out more effectually. [Mr. Hawes explained the nature of the examinations initiated by this Society in connection with the Union of Mechanics' Institutes, by means of which young men had the opportunity of displaying their knowledge and proficiency in various branches of learning, and thus received a stimulus to exert themselves in carrying on their education after leaving school.] In like manner the Society had initiated these competitions, in which the workmen could exhibit the results of their skill and proficiency in various branches of handicraft of an artistic character. He regretted that so small a number of persons had taken advantage of it, and that so few works had been sent in. He had been told that it arose mainly from the fact that the workmen had been so much employed during the year as to have but little leisure to attend to work in overtime. If this were so it was a healthy sign. He had also been told that in selecting the examples the Council had not sufficiently attended to the point that the article to be worked should have a saleable character, and, further, that not sufficient publicity had been given to the competition, so that the various trades were not sufficiently made aware of it. Whether that were so or not he could not say; but means had been taken, by advertisement and by the distribution of programmes in the different workshops, to make the competition known, and more would be done in this direction next year if it were thought necessary. As it was, however, upwards of 600 persons had purchased examples at the Society's house. It was well known that, in 1851, the Exhibition showed how deficient this country was in art-workmen. In 1862, the Exhibition showed a very marked improvement in this direction, and the French Government sent over a Commission to inquire into the causes of it. He (the Chairman) believed it might be attributed mainly to the efforts made at South Kensington, by means of schools of design and otherwise, to improve the art-education of the people. There was, however, much still necessary to be done, and the Society of Arts stepped in, by the offer of prizes, to aid, as far as it could, in stimulating progress, and to do this in a manner not taken up by the Government. He would now ask the meeting to discuss freely the system established by the Society of Arts, and the Council would be glad to hear suggestions and criticisms from any of the working men present. The Council had been told in some quarters that the time laid down in the programme for the execution of the works had not been sufficient, and that the prescribing of designs had fettered the workman, who ought to be left free to exercise his genius and his fancy as he liked. In this he would reply, that though prescribed designs were included in the conditions relating to one portion of the programme, yet, as regards wood-carving, there was a department in which the workman was left free to do as he pleased. On these and various other points he would ask the meeting to express their views.

Mr. NICHOLS (silver chaser) said, in his opinion, it was beneficial that the Council should select and prescribe designs as they had hitherto done. He suggested that the decision as to prizes should be given as soon as possible after the works were sent in. He thought a twelvemonth ample time for the execution of the works for competition, but hoped that more publicity would in future be given. He suggested that in the selection of the designs and examples by the Council advice might with advantage be taken from some of the workmen, both as to the nature of the subjects and the nature and amounts of the prizes.

Mr. MC KENZIE (silver engraver) said he had come expressly from Sheffield to attend this meeting. He thought, as far as his own trade was concerned, ample time was given. Trade had been good during the year, and left the men little leisure for this work in overtime, and this he considered might account for the small number of works sent in.

Mr. MACKIE (wood-carver) said the men had been too busy this year to give time to the competition. He thought a twelvemonth's time would be best, but certainly nothing less than six months should be given. The total amount of prizes offered was ample, but, in his opinion, the prizes should be small and more numerous, as likely to attract a larger number of competitors. He advised drawing and modelling to be added to the list for which prizes should be offered.

Mr. BAKER (wood-carver) objected to competitions of this character. The present exhibition was like other exhibitions of a similar character, a failure. ("No, no.") He repeated it was a failure, for in many branches there was but one work sent in. Such a state of things could scarcely be called a competition. It must be a failure, because it was impossible for a man who had been hard at work all day to do justice either to himself or to his work in overtime. He then proceeded to remark upon some observations which had appeared in the Society's *Journal*, commenting upon the Society's programme of the competition, as by no means warranted, and which he thought were likely to discourage the workmen from competing. These exhibitions, if honest, had a tendency to distinguish the counterfeit from the real, and in so far as they did this they were beneficial. He was, however, afraid they were frequently not honest. It was well known that numbers of good men worked for others, and their works were shown probably as the work of one man, who reaped all the honour and benefit, whilst the man who actually deserved to be rewarded was passed by and lost. Let the Society take steps for catching the men of genius themselves, so that they might become known to the world. The working man of genius wanted something more than prizes—he wanted fame.

Mr. H. COLE, C.B., said he was glad there was some opposition displayed, for if they were all of one mind he feared that there would little good come of the discussion. He thought the objection that the Council were only offering money prizes, and not fame, scarcely correct. In one division of the competition the wood-carvers were free from all trammel, and could

exercise their genius and talent in any manner they liked. He did not agree with the last speaker that the present exhibition was a failure. He thought the present competition by no means unsatisfactory. The execution of the work showed a decided advance over that of last year. He, however, agreed with one of the speakers as to the importance of drawing and modelling, but he did not think, therefore, that they ought to be included in the Society's offer of prizes. It should be recollected that the competition was in art-workmanship; and, as far as drawing and modelling were concerned, there was plenty of competition in each at South Kensington, where prizes and medals were largely given in both subjects. The schools in which these were taught, and where government prizes might be obtained, were easy of access, and at very trifling fees, in every part of the metropolis. Original design required other qualities than art-workmanship did, though no doubt an art-workman was all the better if he could draw, and better still if he could design. For design the government offered rewards, but he did not consider it the duty of government to offer prizes for art-workmanship; that duty he thought properly devolved upon the Society of Arts. He did not agree with those who advised the bringing in as judges persons connected with the trade; he, on the contrary, thought it extremely important that the judges should be men thoroughly independent of all connection with the trade.

Mr. Stewart Harrison (a builder) thought exhibitions of this character were contrary to the spirit of the age, an age which sought rather to convert men into mere machines. The cry for cheapness was the cause of this. One man alone could do nothing; each man was kept to one portion of a work alone. He knew an instance where a man was kept from one year's end to another carving egg and tongue mouldings, and did nothing else. He was permitted to have no other aspiration; his energies and talent were cramped and confined. The movement now taken up by the Society was in the right direction to counteract this debasing influence, and the Council were engaged in a great and noble work.

Mr. P. Graham—If the exhibition was small, it was gratifying to hear that it was caused by the full employment of the workpeople. The Council were glad to have the opportunity of hearing the various opinions of the working men, and diversity of opinion could not fail to be attended with benefit. One thing, however, was clear, that in speaking of the time necessary to be allowed to competitors for executing their work, the period would always depend on the state of trade, as affecting the leisure of the workman. He could, from his own experience, confirm the statement as to the full employment of the men last year, and he was not surprised at the smallness of the exhibition, but, on the contrary, he was surprised there were so many works sent in. All the observations which had been made that evening went to show that the Society was on the right track, but time was required to develope the scheme. There was some diversity of opinion as to the amount of the prizes. He thought the present scale was the right one. No doubt a larger number of smaller prizes might produce more works, but he thought of less value.

Mr. Letheren (smith)—If there were disadvantages affecting the workmen in London, they were nothing as compared with those affecting the workmen in the country. The former had opportunities of inspecting the actual works themselves, whilst the country workman must content himself with the photographs or casts. As regarded amount of overtime at the disposal of the workman, he thought this depended much on the man himself. Where there was a will there was a way. He spoke as a smith, and all knew that a smith's work was not of a very light character. All the work he had sent in was done in overtime. He questioned very much what had been said by one of the speakers as to the work of men being sent in as the masters'.

Mr. Allen (a coachmaker) was not aware till within the last few days that there was any such competition or exhibition as the present. He thought sufficient publicity had not been given to it. In his opinion, however, the evening labour of men in their overtime was not likely to produce good results. He thought, too, that the working men who had ideas would be chary of displaying their designs and giving them to the public.

The Chairman said it must be remembered that, as regarded one division of the programme, the examples were from approved and selected works, and were supplied to the workmen, whilst in another division the wood-carvers had full scope for display of their invention, genius, and talent. He thought that the workman need not be afraid of exhibiting his design, for he felt assured that if it displayed talent it would lead to employment. The great principle on which the whole competition was based, was that of bringing out the talent of the individual workman himself. Such a competition as this distinguished the counterfeit from the true. As to the time for execution, last year it extended from February to November, and, from all he had heard that evening, he concluded it was sufficient. He was not disappointed at the result of the present year's Exhibition, it was in the nature of such movements to be small at first, and he felt assured they would grow. Take the Examinations of the Society, commenced seven years ago with 52 candidates, whilst last year the candidates examined had amounted to 1,200. He did not agree with the remark that competition was injurious. He was glad to see so good an attendance that evening, and in the name of the Council expressed the pleasure it afforded them of meeting the workmen, and hearing their observations, which he was sure would meet with every consideration. The competition would be renewed next year, he hoped, on a more extended scale, and every means would be taken to ensure its being made known to those interested, and he had every confidence it would be well responded to.

The meeting then adjourned, and tea and coffee were served in the library.

Proceedings of Institutions.

Macclesfield Useful Knowledge Society.—The annual meeting and distribution of prizes of this society took place in the Town Hall, on the 8th of November, being the 29th anniversary. E. C. Egerton, Esq., M.P., one of the Vice-Presidents of the Society, took the chair, and observed he was glad to be able to congratulate the committee of the Institution on the increased strength of, and attendance at, the female and juvenile classes. At the same time it was a matter of deep regret that the society—but more particularly, perhaps, that department relating to the School of Design, did not receive that amount of support which it was entitled to, considering the peculiar circumstances of the town and the nature of the manufactures carried on within it, and considering, too, the fact that the prosperity of the town was dependent in a great measure upon the beauty of the design of its fabrics. Among the students to whom prizes would be awarded were those who had gained honours in connection with the School of Design, and it was in regard to that department of the Institution that he wished to say a few words. The meeting was no doubt aware that during the last session of Parliament a committee had been sitting upon the subject of Schools of Design. Many complaints had been made in various parts of the country, that of the large sum of money asked from Parliament, amounting to £100,000 for Schools of Art, a very great proportion was absorbed in the South Kensington Museum, and that only a very small sum indeed found its way into the provinces. The mode of payment, too, adopted by the Government, excited a great deal of discontent on the part of many masters of

Schools of Design. Instead of paying, as formerly, on certificates, carrying with them a payment of £10 each (one master sometimes having as many as five), government determined to pay on what they called "results," these results being confined to the number of medals taken by the artizan class. One evil arising from this mode of payment was, that it excluded those Schools of Design that did not include among their members students of the artizan class, and it was in consequence of the many complaints made that a committee of the House of Commons was appointed, of which he had the honour of being a member. That committee sat two months during the last session, and any one who would take the trouble to look into the blue book relating to it would find there a good deal of valuable and interesting information. They would see the whole history of Schools of Design from their first commencement, and the testimony given of them by such men as Sir Charles Eastlake, Dr. Maclise, and other practical men of science and art; at the same time he (the chairman) was bound to admit that the weight of evidence was against the alteration proposed by the government. The great increase which had taken place in the Schools of Design since their establishment was something amazing. In 1852 the whole cost of the several Schools of Design in London and the provinces amounted to about £15,000; it was now nearly £90,000; and the question very naturally arises, are the results equal to this large outlay? He thought he should be justified in saying that the country had received substantial benefits in the shape not only of higher tastes among the artisan class, but more intellectual refinements, which had exercised a beneficial influence on both the middle and the working classes, and much of this he believed was attributable to Schools of Design, and institutions such as that in support of which they were met that evening. The Honorary Secretary next read the report. During the past year the number of members has been:—Honorary, 198; ordinary, 189; female and junior members of classes, 113; making a total of 500. The classes are constituted as follows:—

Adult.	Teacher.	Avge. Att.	No. on Books
Arithmetic	Mr. S. Wood ...	25	46
Reading and Writing...	Mr. Botheras ...	16	52
Grammar	Mr. Barber	13	22
Geography and History	Mr. Botheras ...	12	49
Chemistry	Mr. Wire	—	—
French....................	M. Dumont... ..	7	—
Singing	Mr. Hambleton	15	20
Female.			
General Instruction ...	Mr. Malburn ...	26	45
Sewing.....................	Mrs. T. Jeffery	17	
Juvenile.			
General Instruction ...	Mr. Malburn, jun.	38	70

The Committee have great pleasure in noticing the improved state of the classes, and especially rejoice in the continued prosperity of the junior class, because they believe that the chief good here obtained is not so much in the amount of knowledge gained as in the mental habits induced, and yet still more in the moral habits induced through these. During the past year the students have passed through three examinations—the first, that of the Society of Arts in its preliminary and final stages; the second, that of the Government Department of Science and Art; and the third, our own, conducted by the members of the Class Committee. The circulation of the works in the library has been 11,500 volumes, a less number than during the year 1863; but the committee are pleased to report that the works read have been of a higher character than of late years, literature of a scientific class having been much more in demand. Only about 50 volumes have been added to the library. During the past year several lectures and entertainments have been provided by the Committee: J. C. Buckmaster, Esq., B.A., F.C.S., delivered a lecture upon "The Advantages of a Knowledge of Science and Art;" the Rev. J. J. Wray, a lecture upon "Venice;" a concert under the conduct of Mr. Ellis Roberts, harpist to H.R.H. the Prince of Wales; a dramatical and musical entertainment, kindly given in aid of the society by Messrs. Nosworthy, Smith, and Gregory, of the Manchester Amateur Societies; and more lately, a concert conducted by Mr. Twiss. These lectures and concerts have proved more successful than those held for some time previously. The committee having noticed the success of the "Penny Readings" in the town, and having learnt that they were not to be continued this season, decided to arrange a series of "Monday Popular Entertainments," which should in a measure aim to serve the same good purpose, and also aid in bringing the Society more constantly before the notice of the public. Three of these entertainments have been held, each one attended by a numerous and interested audience. The committee cannot, however, forbear naming how far their efforts in this direction are partially frustrated by the want of a suitable music and lecture hall.

DUBLIN INTERNATIONAL EXHIBITION, 1865.

Scotland has taken up representation at the Dublin Exhibition with characteristic energy. The Provosts and Chief Magistrates of Edinburgh, Leith, Dundee, and Aberdeen, &c., head the movement. It is expected that Edinburgh will send as much to Dublin as to the last London International Exhibition. The Committee at Edinburgh includes the following influential persons:—The Lord Provost, Bailie Cassels, Bailie Alexander, Bailie Hill, Bailie Handyside, Bailie Falshaw, Bailie Miller, George Lorimer, Henry Callender, Adam Beattie, Charles Macgibbon, James MacKnight, John Kay, Thomas Dryborough, James Ford, the Master of the Merchant Company, the Chairman of the Chamber of Commerce, the Dean of the Faculty of Advocates, the Deputy Keeper of the Signet, the Preses of the Society of S.S.G., the Preses of the Society of Chartered Accountants, the Presidents of the Royal Scottish Academy, of the Royal Scottish Society of Arts, of the Royal College of Physicians, of the Royal College of Surgeons, the Provost and Magistrates of Leith, the President of the Merchant Company, and the President of the Chamber of Commerce of Leith.

Turning to the Continent, we find that from Brussels the list of demands already numbers 110 applicants in the Industrial Department, and 117 artists. Two organs are offered, and a large number of other musical instruments.

Forty of the best artists of Düsseldorf have given their adhesion, and a large number of the Scandinavian painters, headed by M. Adolph Tidemand. Munich will furnish cartoons of the most celebrated artists, and all the leading painters will contribute, including Kaulbach, Schwind, Piloty, Froltz, and Schraudolph.

Great interest is manifested among the industrial and commercial classes of Prussia in regard to the forthcoming International Exhibition of Industry and Fine Arts in Dublin. This is especially true of the manufacturing districts of Rhineland and Westphalia. The Commercial and Industrial Society for Rhineland and Westphalia, whose domicile is in the flourishing Rhenish city of Dusseldorf, at its last general meeting appointed its committee to be the local committee for advancing the objects of the Exhibition in the two provinces in question. In Dusseldorf, too, resides Herr Von Sybel, who has been appointed by the Dublin Committee as its commissary for Prussia. In all the principal papers of Berlin, and, indeed, of Prussia at large, this gentleman has inserted advertisements inviting the commercial and manufacturing classes in all parts of this country to become exhibitors. The response on the part of the latter has turned out so far highly satisfactory, and Prussia may be expected to make a very respectable show in the Dublin Exhibition during the coming summer.

STRATFORD INDUSTRIAL EXHIBITION.

On Tuesday, the 27th December, a meeting took place in the buildings of the National Schools belonging to St. John's Church, Stratford, to open an Industrial Exhibition of works of art and manufactures, for the purpose of raising funds for the completion of a Workmen's Hall and Club for the artisans now congregated in the populous parishes of West Ham, Stratford, &c.

This movement has been most warmly taken up and promoted by the inhabitants generally, and the schools on this occasion were filled to overflowing by the ladies and gentry of the neighbourhood. The exhibition of paintings, water-colours, and drawings especially attracted attention, many of them by amateurs, which were contributed for sale in aid of the funds of the proposed Institution. There is also a large collection of objects of natural history, mechanical contrivances, and manufactures. The proceedings commenced at twelve o'clock, by the choir singing the Hallelujah Chorus. The secretary then called upon the Rev. A. J. Ram, the vicar of the mother parish, to open the exhibition, and in doing so expatiated on the benefits of such exhibitions as this, and of the blessings which a hall and club were calculated to confer on the working classes. He congratulated the meeting on the success which had crowned the labours of the Committee (mostly working men), and complimented them upon having been able to collect so large a display of works of industry and art.—Mr. Antonio Brady then addressed the meeting, and in doing so said he felt it a great honour to be associated with this movement, and had lent his choicest pictures and works of art with the greatest pleasure. He could only attribute his being called upon to speak first, to his position as one of the trustees of the schools, and to his taking so great an interest in the cause of education. He felt that this exhibition was education in the highest and truest sense of the word, and it afforded him much satisfaction that the trustees had lent the schools as desired. Mr. Brady then spoke to the working men, and showed the vast difficulties of artisans in earlier times contrasted with the present. He directed attention to the remains of the mammoth on the table, which he had lately procured from a neighbouring brick-field, being part of one of very many of those ancient inhabitants of Stratford whose race was now extinct upon the earth. He then pointed to the magnificent collection of flint and other stone tools in the adjoining cases, some of which had been used by man, the contemporary of the mammoth and other extinct mammalia which formerly roamed in these districts in countless numbers, the quantities of mammalian remains found in this neighbourhood being almost fabulous. The flint tools consisted of axes and tomahawks from Amiens and Abbeville in France, and hammers, chisels, saws, knives, spear-heads, daggers, sling-stones, &c., from the lower peat formations in Denmark. Mr. Brady shortly described the age of those instruments by the flora of the then existing country. He stated that the Danish antiquaries and naturalists, Professors Nilsson, Forchammer, Thomsen, Worsäae, and others, have succeeded in establishing a chronological succession of periods, which they have called the ages of stone, of bronze, and of iron, named from the materials which have each in their turn served for the fabrication of implements, specimens of each of which Mr. Brady had lately obtained in Scandinavia, and had placed on the tables. The age of stone in Denmark was represented by the period when the Scotch fir flourished, and is the principal vegetation found with the flint and other stone tools at the bottom of the peat formations. The bronze age coincided with the time when the Scotch fir had given place to forests of oak, bronze tools, swords, spears, shields, &c., being found in the middle peat associated with acorns and stems of the oak. This was succeeded by the dawn of the present period, and is represented by iron tools, much of the same character, found on the top growth of the peat, associated with forests of birch and beech, the oak and the Scotch fir being now only found in these parts in a state of cultivation. It would seem, at first sight, strange that primitive man should first have fashioned his tools of a compound metal—bronze; but as iron is mostly only found in the state of an oxide, and the other metals of which bronze is compounded often occur in a metallic state, it is only natural that man should have first learned the use of them, the chemical knowledge necessary for the reduction of iron showing an immense stride in civilisation and the arts. The tools make it apparent that weapons of defence and offence were the first necessities of our race, "when wild in woods the noble savage ran." He used flint knives to skin his animals for clothing and food, and made wedges and axes to fashion wood for his hut, or to hollow out trees for his tiny bark, wherein he pursued good old Isaac's gentle art with spear and arrow-heads wherewith to kill his game; and, for truth's sake be it added, with daggers and other offensive weapons, it is feared, for a less holy purpose. We thus trace, by means of these antiquities, the progress of man by slow degrees, until after the lapse of countless ages (how many is known only to Him to whom a thousand years are as one day,) we are able to compare these ancient tools, which date from the era when the mammoth and the rhinoceros walked this earth, with the elaborate and exquisitely-finished machine tools of the present day. We thus see how the flint arrow-head has given place to the Minie rifle or the Armstrong gun; we can point to the iron horse of the railway, which never tires; to the steam-engine printing-press; and the electric telegraph, which latter is doubtless the greatest achievement of man in subduing the elements to his service. We span the earth as it were with a girdle, and catch a flash of lightning wherewith to convey our thoughts through the sea to the uttermost parts of the earth. Yet, to show that civilisation is not complete, and that man still lives in remote islands without the use of improved materials, Mr. Brady pointed to a fish-hook made of wood, and to a tomahawk with a stone axe for its cutting edge, which his brother lately brought from the Louisiade Archipelago, where metals are still unknown. Thus, interchange of thought and comparison of what one man can do with the work of another is the great means of progress and the great advantage of such exhibitions as these. Lord Bacon truly says, "Knowledge is power, and is the accumulated wisdom and experience of all men and all ages." Then let us profit by such educational exhibitions as these. After some further remarks of a general nature, the speaker paid a warm tribute to the exertions of the Committee by whom the rooms had been so beautifully decorated and arranged; and especially, he thought, that a vote of thanks was due to Mr. and Mrs. Warner and family—the first idea of this Hall and Club, now on the point of being realised, being due to Mrs. Warner.

The meeting was then addressed by Mr. Bassett, an artisan; Mr. C. Tanner; and Mr. Johnson, a working man.

The National Anthem was effectively sung by the choir. The Rev. Mr. Keogh then moved a vote of thanks to the Vicar for presiding, which was seconded and carried unanimously.

The Rev. A. J. Ram briefly responded, and formally declared the exhibition open.

ON PERFUMES, FLOWER FARMING, AND THE METHODS OF OBTAINING THE ODOURS OF PLANTS.

By Septimus Piesse, Ph. D., F.C.S.

The following lecture has been delivered before the Royal Horticultural Society, and illustrated with living plants:—

Perfumes that are derived from plants, may be, for the

purpose of description, conveniently divided into three classes.

Class I. are the most ancient, and have been in use from the earliest period of which there is record. They consist of the various odoriferous gum-resins, which exude naturally from the trees which yield them; and to increase the produce, the plants are often purposely wounded. The most important are benzoin, olibanum, myrrh, and camphor. No less than 5,000 cwt. of these together are annually imported into Britain. Gum-resins form the chief ingredients in incense and in pastilles.

We have here specimens of benzoin, myrrh, frankincense, camphor, and numerous others.

These odorous bodies are principally consumed in certain religious ceremonies, and from the early custom of burning incense upon the holy altar, our word perfume, from *per fumus* (by smoke), has been derived.

You will find displayed here some fine specimens of art workmanship in the contrivances for burning incense, and like bodies for fumigation.

We may include in this class all those parts of plants which are fragrant, such as the long seed-pod of the vanilla plant; the bean of the *Dipterix odorata*, or tonquin bean, which our grandfathers carried in their snuff boxes; the root of the *Iris florentina*, or orris root, about 25 tons of which are consumed every year by Britannia at her toilet; the rhizome of an Indian grass, known as vitivert or kus-kus; fragrant woods, such as the santal, and the myall, or violet wood of Australia; odoriferous seeds, as carraway and nutmeg; in fact, our first division includes every vegetable substance which has a pleasing fragrance, like some dried flowers. Perfumers grind these several bodies to powder, then mix them in various proportions; the results are, the various sachet powders in such universal use, *i e.*, examples of which are now given.

Class II. are those perfumes which are procured by distillation. This is the first step to separate the odorous principle from the material which contains it. As soon as the Greeks and the Romans learned the use of the still, which was an invention imported by them from Egypt, they quickly adapted it to the separation of the odorous principle from the numerous fragrance-bearing plants which are indigenous to Greece and Italy. An essential oil, or otto, thus procured from orange-flowers bears in commerce to this day the name of Neroly, supposed to be so named after the Emperor Nero. Long before that time, however, fragrant waters were in use in Arabia, as all may learn who read the Arabian Nights. Odour-bearing plants contain the fragrant principle in minute glands or sacs; these are found sometimes in the rind of the fruit, as the lemon and orange; in others, it is in the leaves, as sage, mint, and thyme; in wood, as rosewood and sandal wood; in the bark, as cassia and cinnamon; in seeds, as carraway and nutmeg. These glands or bags of fragrance may be plainly seen in a thin cut stratum of orange-peel, from which the otto may be easily pressed out on to paper; so also in a bay leaf, if it be held up to the sunlight, all the oil-cells may be seen like specks. All these fragrant-bearing substances yield by distillation an otto peculiar to each; thus is procured otto of patchouly from the leaves of the patchouly plant, *Pogostemon patchouly*, a native of Burmah; otto of carraway, from the carraway seed; otto of geranium, from the leaves of the *Geranium rosa;* otto of lemon, from lemon peel; and a hundred others of more infinite variety.

All the various ottos are very slightly soluble in water, so that in the process of distillation the water which comes over is always fragrant. Thus elder water, rose water, orange water, dill water, are, as it were, the residue of the distillation after obtaining the several ottos. A variety of these fragrant waters will be found here. We may distil so much of the plant with water as is just sufficient to render the water fragrant without any otto floating upon it. This is the practice when the water alone is the object of distillation. The process of distillation is very simple; the fragrant part of the plant is put into the still and covered with water; and when the water is made to boil, the ottos rise along with the steam, are condensed with it in the pipe, and remain floating on the water, from which they are easily separated by decanting. Models of the still are here shown, and on the wall we have a sectional diagram of this wonderful instrument. In this way 100 pounds of orange, lemon, or bergamot fruit peel will yield about 10 ounces of the fragrant otto; 100 pounds of cedar wood will give about 15 ounces of otto of cedar; 100 pounds of nutmeg will yield 60 to 70 ounces of otto of nutmeg; 100 pounds of geranium leaves will yield 2 ounces of otto. A simple mode of procuring the ottos from orange, lemon, and bergamot is practised in Italy. The fruit is rasped, the pulp produced is then pressed. The odours of the fruit thus procured are much finer than those obtained by distillation.

Every fragrant substance varies in yield of essential otto. The variety of ottos are as numerous as fragrant plants; but there is a certain relationship among odours as among tints. The lemon-like odours are the most numerous, such as verbena, lemon, bergamot, orange, citron, citronella; then the almond-like odours, such as heliotrope, vanilla, violet; then spice odours, cloves, cinnamon, cassia. The whole may be classified into twelve well-defined groups. All these ottos are very soluble in alcohol, in fat, butter, and fixed oils. They also mix with soap, snuff, starch, sugar, chalk, and other bodies, to which they impart their fragrance. And it is thus that we are enabled to transfer the odorous principle from the plant that produces it to an inodorous body, wanting fragrance alone to make it of commercial value.

The principal consumption of the various fragrant ottos is for scenting soap. Windsor soap, almond soap, rose soap, and a great variety of others, consist of various soaps made of oil and tallow, perfumed while in a melted state with the several named ottos or mixtures of them.

Though snuff is by no means so popular an article in the reign of Victoria as it was in Anne's time, yet the increased population, and still more increased exports to colonies, cause a much larger production of scented snuff now than was the case fifty years ago; snuff perfumed with bergamot is especially in demand in the fur countries of Northern Canada. There is a large consumption of fragrant essential oils in the manufacture of toilet powders. Under the various names of rose powder, violet powder, &c., a mixture of starch and orris root powdered, differently scented, is in general demand for drying the skin after the bath.

More than 200,000 pounds weight of various ottos were imported into Britain in 1860, and valued at over £180,000; to this must be added at least one-third as much again distilled in England. Of the imported articles enumerated, oils of lemon and bergamot, from the Two Sicilies, reached 128,809 pounds, valued at £57,054.

Samples of various ottos are to be seen here, and so far as is practicable you will find also the living plant, or dried specimen, from which the odour is derived.

We now pass to Class 3.—These are the perfumes proper, such as are used for perfuming handkerchiefs. Contrary to the general belief, nearly all the perfumes derived from flowers are not made by distillation, but by the processes of *enfleurage* or inflowering, and by maceration or infusion.

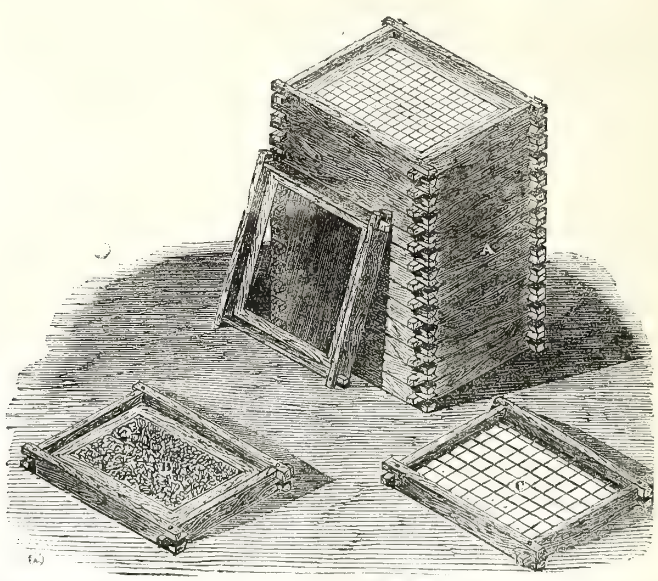
The odours of flowers do not, as a general rule, exist in them as a store or in a gland, but they are developed as an exhalation. While the flower breathes it yields fragrance; but kill the flower, and fragrance ceases. It has not been ascertained when the discovery was made of condensing, as it were, the breath of the flower during life; what we know now is, that if a living flower be placed near to butter, grease, animal fat, or oil, these bodies absorb the odour given off by the blossom, and in turn themselves become fragrant. If we spread fresh unsalted butter upon the inside of two dessert-plates, and then fill one of the plates with gathered fragrant blossoms

of clematis, covering them over with the second greased plate, we shall find that after twenty-four hours the grease has become fragrant. The blossoms, though separated from the parent stem, do not die for some time, but live and exhale odour; which is absorbed by the fat. To remove the odour from the fat, the fat must be scraped off the plates and put into alcohol; the odour then leaves the grease and enters into the spirit, which thus becomes "scent," and the grease again becomes odourless.

The flower farmers of the Var follow precisely this method on a very large scale, with but a little practical variation, with the following flowers—rose, orange, acacia, violet, jasmine, tuberose, and jonquil. The process is termed, as said before, *enfleurage* or inflowering. In the valley of the Var, there are acres of jasmine, of tuberose, of violets, and the other flowers named; in due season the air is laden with fragrance—the flower harvest is at hand. Women and children gather the blossoms, which they place in little panniers, like fishermen's baskets, hung over the shoulders. They are then carried to the laboratory of flowers and weighed. In the laboratory the harvest of flowers has been anticipated. During the previous winter great quantities of grease, lard, and beef-suet have been collected, melted, washed, and clarified. The great success of this process depends on the absolute purity of the grease employed, and no pains are spared to this end. In each laboratory there are several thousand *chassis* (sashes), or framed glasses, upon which the grease to be scented is spread, and upon this grease the blossoms are sprinkled or laid. The *chasse en verre* is, in fact, a frame with a glass in it as near as possible like a window-sash, only that the frame is two inches thicker, so that when one châsse is placed on another, there is a space of four inches between every two glasses, thus allowing room for blossoms. Every châsse, or sash, is about two feet long by eighteen inches broad, as here seen. The flower blossoms are changed every day, or every other day, as is convenient in regard to the general work of the laboratory or flowering of the plants. The same grease, however, remains in the châsse so long as the particular plant being used yields blossoms. Each time the fresh flowers are put on, the grease is "worked"—that is serrated with a knife—so as to offer a fresh surface of grease to absorb odour. The grease being inflowered in this way for three weeks or more—in fact, so long as the plants produce blossoms—is at last scraped off the châsse, melted, strained, and poured into tin canisters, and is now fit for exportation. We have here specimens of fat thus inflowered.

In every moderate-sized flower laboratory there are employed from two to three thousand sashes.

Fat or oil is perfumed with these same flowers by the process of maceration; that is, infusion of the flowers in oil or melted fat. For this end, purified fat is melted in a *bain marie*, or warm bath, and the fresh blossoms are infused in it for several hours. Fresh flowers being procured, the spent blossoms are strained away, and new flowers added repeatedly, so long as they can be procured. The *bain marie* is used in order to prevent the grease becoming too hot from exposure to the naked fire; so long as the grease is fluid, it is warm enough. Oil does not require to be warmed, but improved results are obtained when it is slightly heated.



A represents a pile of glass sashes.
B represents a sash with lard and flowers upon it.
C represents a wire sash for the enfleurage of oil upon a cotton fabric.

We have upon the wall here a sketch showing the water-bath for melting the fat or warming the oil.

Jasmine and tuberose produce best perfumed grease by enfleurage, but rose, orange, and acacia give more satisfactory products by maceration; while violet and jonquil grease is best obtained by the joint processes—enfleurage followed by maceration.

We have here a *chasse en fer*, this is for the enfleurage of oil. In the place of glass, the space is filled with a wire net; on which is laid a *molleton*, or thick cotton fabric—moleskin, soaked with oil; on this the flowers are laid, just as with solid grease. In due time—that is, after repeated changing the flowers—the oil becomes fragrant, and it is then pressed out of the moleskin cloth. Oil of jasmine, tuberose, &c., are prepared in this way.

There is certainly something inscrutable to an Englishman about olive oil; he only knows it as it were with a lamp-like odour; but the olive oil that is pressed from the native fruit of the Valley of Cannes, has less taste and less odour than the finest Aylesbury fresh butter. Such oil therefore is admirably adapted for inflowering for it is obvious that bodies which have no odour of their

own, are more easily perfumed than those in which the original odour has to be overcome before they smell of the substance with which they are odorated.

In order to obtain the perfume of these flowers in the form used for scenting handkerchiefs, we have to infuse the scented fat or oil, made by any of the above methods, in strong alcohol.

In extracting the odour from solid fat, it has to be chopped up fine, as suet is chopped, or melted, and then put into the spirit, and left to infuse for about a month. In the case of scented oil it has to be repeatedly agitated with the spirit. The result is that the spirit extracts all the odour from the fatty body, becoming itself "perfume," while the grease again becomes odourless; thus is procured the essence of jasmine, essence of orange flowers, essence of violets, and others already named, rose, tuberose, acacia, and jonquil.

It is remarkable that these flowers yield perfumes which, either separate or mixed in various proportions, are the types of nearly all flower odours; thus, when jasmine and orange flowers are blended, the scent produced is like sweet-pea; when jasmine and tuberose are mixed, the perfume is that of the hyacinth. We will practically exemplify this; thus all the various bouquets and nosegays, such as "frangipanni," "white roses," "sweet daphne," are made upon this principle.

The commercial importance of this branch of perfumes may be indicated by the quantity of flowers annually grown in the district of Cannes. Flower harvest: Orange blossoms, 1,475,000 lbs.; roses, 530,000 lbs.; jasmine, 100,000 lbs.; violets, 75,000 lbs.; acacia, 45,000 lbs.; geranium, 30,000 lbs; tuberose, 24,000 lbs.; jonquil, 5,000 lbs. The quantity produced at Nice I have been unable to ascertain; with violets and orange there are more, but with cassie less, than here stated.

In growing flowers for perfumery the item of wages is, of course, important. In the Valley of the Var, the summer wages are 2s. 4d. a day for those men who do the heavy work of the fields, and 1s. 1d. a day for the women who attend to the flowers. In winter, which is but of short duration, the wages are 2s. a day for men, and 10d. for women.

Nothing can be simpler or more primitive than the farming operations. Roses for example. The field is first scantily manured, especially with the refuse matter left after the distillation of various plants; it is then ploughed with oxen at the yoke. Young plants of roses, procured from layers, in the usual way, by tongueing and layering at a joint, are then planted, and Nature does the rest. The cabbage Provence rose is the kind cultivated. In the second year a considerable quantity of flowers appear, but it is not until the fourth year that they are fully developed. A plantation of roses well tended will last from six to eight years; but for this the land must be well drained. It requires about 7,000 rose plants to cover an acre, and this acre will produce, in an average season, 5,000 pounds' weight of roses of the value of 1d. to 1½d. per pound, yielding, say £30 an acre.

For cassie (*Acacia farnesiana*) the land is prepared in a similar way. The young plants are raised from seed, which is sown in beds. The best plants are left, the doubtful ones removed. In the third year they have generally a height of two or three feet, and are then planted out in fields, each tree requiring about twelve feet square. The blossoms of the cassie are successive, some being ready for plucking while the others are scarcely formed. This is immensely useful to the farmer, one lot of blossoms being gathered and passed through the laboratory before it is time to gather the others. After the third year the tree produces flowers, growing at the same time till they attain maturity, when they reach a height of ten or twelve feet, with branches six feet long, and a stem as thick as a man's wrist. Each full grown tree will produce about two pounds' weight of flowers, value from 3d. to 4d. per pound, say £30 to £40 per acre.

The jasmine is cultivated by slips of the wild jasmine (that which is seen in our English gardens) grafted, at the end of two years, with the Spanish jasmine (*Jasminum grandiflorum*). This produces a blossom the size of a shilling, of intense fragrance. It requires about 8,000 plants to stock an acre; and they are not in full bearing till the second year after grafting; but when mature, every thousand plants yield about sixty pounds' weight of flowers annually. They are planted in rows, horizontal poles being thrust between them for support, the branches are woven in and out, somewhat as the raspberry canes are arranged by the Chiswick gardeners. Every August —the jasmine season—the fields are alive with women, old and young, and children, each having a little basket at her side suspended by a strap across her shoulders, both hands actively engaged in picking the flowers, and filling the baskets. As each basket is filled it is conveyed to the shaded laboratory and there weighed. An acre of land will yield about 500 pounds' weight of jasmine blossoms. The value of the blossoms varies from 1s. to 1s. 6d. per pound.

The tuberose needs more care than any other flower of the farm. It is the most difficult to rear, but the best worth rearing. A good plantation on a good soil will last for seven or eight years. It is a bulbous plant, and propagates as they do; it throws out a stem like a hyacinth, covered with fleshy flowers. And oh! what a fragrance breathes from it! what a bouquet, snatching perfumes from every flower with a superb eclecticism!

"The Tuberose, with her silv'ry light,
That in the garden of Malay
Is called the mistress of the night,
So like a bride, scented and bright,
She comes out when the sun's away."

Orange-trees are raised from seeds; at the third year they are grafted, either with the sweet Portugal or bitter Bigaradier. A tree requires fifteen years to reach maturity, but will produce both flowers and fruit in four or five years. When in full vigour, each tree yields an average of twenty-five pounds' weight of blossoms annually. Many plantations of orange-trees at Nice are more than one hundred years old. At Fontainebleau there are now to be seen orange-trees planted by an ancestor of mine two hundred years ago. At Nice there is a public market for orange-blossoms during the season; the bitter orange-flowers fetch 3d. per lb., the sweet about 2d.

The orange-tree yields not only the exquisite odour of the flowers by the enfleurage process, of which there are several examples here, but also the otto from the flowers by distillation; there is also quite a different smelling otto from the epidermis of the fruit, as here shown, and also a very fine otto from the leaves.

The market season for orange-flowers at Nice lasts for more than a month, as an average, and during that time there are sold about fifteen to eighteen tons of flowers daily! a ton of flowers will yield more than a kilogramme of otto, say forty ounces, worth £20 sterling; and the residuary water, highly saturated with odour, is worth another £10 note.

With us the violet grows anywhere, and almost anyhow; but the terrible sun of Nice, during July and August, is but ill borne by the violet. Consequently, on the farms they are planted under the green shade of the orange and lemon trees, or close to walls and houses. The method of propagation is division of the roots. They are planted so as to grow in tufts or clusters about a foot apart all round; and this space enables the growers to gather the flowers without treading on them. A surface of land, equalling an acre of planting, yields one hundred and eighty to two hundred pounds' weight of flowers, valued as an average at two francs the pound. Violets may always be looked upon as an extra crop, growing as they do under the orange and lemon trees. The kind grown is the double Parma. About twenty-

five tons weight of violet blossoms are produced annually at Nice.

Oak-leaf or rose-leaf geraniums are grown for the sake of the rose-like odour extracted by distillation from their leaves. A ton of leaves will yield about a kilogramme, or rather less, of otto. The geranium is propagated by cuttings made in September, which are planted out in the spring.

Rosemary, lavender and thyme are also grown to a vast extent. One can hardly say "cultivated," since they grow like the broom and heath on the wild wolds of Yorkshire. Any quantity may be found on the high regions of the Maritime Alps. Those persons who seek for the ottos of these plants carry the distilling apparatus up the hills upon the backs of mules, while they encamp themselves in tents near to some snow stream.

England has always been famous for the production of lavender, and farms of it exist at Carshalton and Mitcham, in Surrey; also at Hitchin, in Hertfordshire. It requires about 3,500 plants to an acre, and when the plant is in full bearing we can procure from this quantity about six to seven quarts of otto, which, at the present price of 54s. per lb., a good average price of ten years, yield £32 per acre.

Although the mode of obtaining the odours from flowers by enfleurage and maceration, has certainly been in practice for two centuries in the valley of the Var, in the south of France, it is only by my publications that the method has been made generally known in England.

The works published relating to perfumery are very few. In France, where this commerce has risen annually to the value of £3,000,000 sterling, there are no published accounts or statistics by a native author, relating to flower farming. My own little book, "The Art of Perfumery," has recently been translated into French, by Dr. Baveil, of Paris, and is published by Ballière. No cyclopædia, which is more than ten years old, makes even mention of the inflowering process, as a source of entrapping the exquisite odour of flowers, nor do any of the multitude of books relating to economic gardening, notice this fact.

No wonder then that gardeners and horticulturists generally, are unacquainted with this simple source of wealth, and if I interpret right the object of the Council of this Society now in bringing the subject of the odours of plants before the fellows, it is that young gardeners, aspiring to emigrate to some of the warm British Colonies, may eventually lay there the foundation of a flower farm and perfume laboratory, such as can only now be seen on the banks of the Var.

Fine Arts.

Art in Ireland.—The following letters have been addressed to the editor of the *Times*, in answer to a leader, in which some remarks disparaging to Irish Art were made:—

"Sir,—A word or two, if you please, in answer to some of your assertions that "art is not in Irish people," and that "in Ireland, nature and art do not get up their usual friendship" and to your "doubts of the possibility of an Irish School of Art." Ecclesiastes tells us whatever has been shall be; and it is the fact that in some remote age there was an Irish School of Art, one as marked as the Etruscan, of the truth of which a visit to the Irish academy will satisfy you. You will find there a collection of ornament in gold which in quantity rivals that at Naples or Rome, and in artistic quality is not inferior to the works of the Greeks. The book of Kells and other illuminated MSS. on Irish art are as peculiar and fine of their kind as any MSS. of any age or country. For two centuries architecture certainly has been no better in Ireland than in England; and if we find Dublin "overdone with huge porticoes, towering domes," and the like, we may recollect that within forty years the architectural genius of England could do nothing more original than the British Museum and the General Post Office, and crib from the temple of Theseus innumerable stucco versions of porticoes to front Unitarian chapels. Art not in the Irish people! Last year we lost Mulready, whose pictures united qualities found but separately in Van Eyck, Beato Angelico, and Ostade, with a power of correct drawing equal to that found in Greek gems—and Mulready was born at Ennis. What living artist, in France or Germany, or modern Italy, has painted a more noble wall decoration than the Battle of Waterloo in the Houses of Parliament? and Daniel Maclise came from Cork, and first copied those "plaster busts in the Cork School of Art" which you seem to hold in some contempt. I venture to think that modern art has produced no finer work than this water-glass picture, a process which the artist was the first to introduce into this country. And is not Foley, too, an Irishman, at the head of British sculptors? and may not the "Eve" of MacDowell, the sculptor, an Irishman, challenge most modern works in France and Italy for excellence? Allow me also to tell you that there is "such a thing as a National Gallery in Dublin," the best lighted picture gallery that has been built, where a man can walk in almost when he pleases, even on a Sunday afternoon, as Mr. Sheepshanks wished should be done at Kensington. And it is not true that Schools of Art "do not encourage attempts to draw from life and nature." The copy of their programmes which I enclose, show the contrary. And I would venture to ask you to improve your acquaintance with Schools of Art, which you say is not extensive. I am not an Irishman, but I hope you will allow me this opportunity of raising for a moment a shillaleh in defence of art in Ireland.—Felix Summerly.

Sir,—In a leading article in your journal of yesterday in reference to the recent distribution of prizes to the students in the Government Schools of Design at the Royal Dublin Society, the following paragraph occurs:—"There is no such thing as a National Gallery in Dublin. There is no collection of pictures and sculpture, or other works of art that a man can walk into any hour that he pleases, or even once or twice a week." I am happy to inform you that there is a National Gallery in Dublin; that it includes paintings and sculpture in its collection; that it is open gratuitously to the public on all days of the week, with the exception of Fridays and Saturdays, which are reserved for artists and students, but on which days the public also are admitted at a small charge, and that it is the first institution of the kind in the three kingdoms which has opened its doors for the benefit of the working-classes on Sundays after the hours of Divine service. The gallery was opened on the 1st of February of this year, and the recorded number of visitors up to the present exceeds 167,000, although it was completely closed during the month of October. I send you a catalogue, in the prefatory part of which you will find a brief account of the origin and establishment of the institution; and will perceive that for its collections, however inadequate to public requirements, it is up to the present mainly indebted to private liberality. It is not in my province to comment on the tone and bearing of the article in which so strange an unacquaintance is manifested with the existence of a public institution, the subject of frequent Parliamentary grants; my simple duty is to request that you will, by the publication of this letter, disabuse your readers of the error of supposing there is no National Gallery in Dublin.—George F. Mulvany, Director.

Merrion-square West, Dublin, Dec. 29.

Manufactures.

The Scotch Iron Trade.—According to the authenticated returns of the ironmasters, the production of pig iron in 1864 has attained the amount of 1,160,000 tons,

which, at the average price of this year for mixed numbers, reaches the sum of £3,320,000. There have been in blast throughout the year 134 furnaces, giving employment to about 50,000 men. The shipments—foreign and coastwise—and local consumption have sprung up to the grand total of 1,156,000 tons. The stock of pig iron in Scotland, as ascertained by the committee appointed by the iron trade, is now 760,000 tons, thus showing a trifling increase of 4,000 tons. In 1864 the price of pig iron has fluctuated from 67s. to 49s. 3d., giving an average of 57s. 3d. per ton. The demand for malleable iron this year is without a parallel in the history of that material. It is computed that 210,000 tons of pig iron have been used in producing 163,500 tons of bar, sheet, plate, and angle iron, during the last twelve months, whilst our foundries have consumed 270,000 tons.

The Cotton Trade.—Messrs. Smith, Edwards, and Co., of Liverpool, report as follows in their Annual Cotton Circular:—The experience of the past year has rather damped the sanguine hopes of those who expected that the vacuum created by this American war would be soon filled up. The opinion was entertained in Lancashire twelve months ago, with the force of a conviction, that 1865 would witness practically the termination of the great cotton crisis, and that, too, irrespective of aid from America. These sanguine auguries have not been fulfilled. The difficulty of replacing a vast cotton field like that of the Southern States is now more fully recognised, and we enter the year 1865 with more sober anticipations than prevailed at the beginning of the last one. Our chief reliance since the American war commenced has been upon the expansion of cotton cultivation in India, but year after year that country has dissappointed us, and now, in the fourth year of the war, we are promised no more than in the first. The export of cotton from Bombay for the years 1861, 1862, 1863, and 1864, has scarcely varied from a million of bales, and the general expectation in Bombay is that it will not exceed that amount in 1865. The reports of the growing crop are not favourable; the rains were deficient, and the plant in many places is not looking well; neither was there any increase of planting this season. The scarcity and dearness of food were excessive through all the west of India, and the ryots dared not extend the cultivation for fear of bringing on a famine. From the north-west Provinces, where the Bengal cotton is grown, a large increase of planting is reported, but the crops are said to be deficient. From the South of India some increase is expected. Looking broadly at the case, it may be hoped that India will give a small increase next year, the more so as a large part of the old crop at Bombay has been held back in consequence of the late panic, and will be shipped freely in the early months of the year. Perhaps an increase of 100,000 or 200,000 bales may be received from India this year, but even that appears very doubtful. From China there has been a steady increase of supply since the trade commenced. The import for 1864 sums up to the large total of 399,000 bales, equal in weight (supposing the bales to average a little under two piculs) to nearly 250,000 Surat, or 200,000 American. Since the present season opened the shipments from China are nearly double those of last year, say 200,000 piculs against 106,000. So it is fair to expect a large increase for the whole year, though hardly in the same ratio as this. From Egypt the accounts are most encouraging; cotton culture in that fertile country makes rapid strides from year to year, and it is generally thought that this crop will exceed the last by 25 per cent.; some say considerably more. We have received from Egypt 257,000 bales this year; it is not unlikely we may get 320,000 bales, or even more, next year. From Brazil a large increase is also expected, perhaps 50,000 bales; but, on the other hand, the prospects of supply from America are not so good. The blockade of the Southern ports is becoming more rigid. At Nassau, the chief depot for blockade runners from the Atlantic coast, there is a suspension of business, and the vessels are leaving for other employment. From Texas there may be a fair supply, but the aggregate 'leakage' from the Cotton States is expected to be less in 1865 than in 1861. From Turkey the accounts of the crops are very unpromising; though a much larger area was planted the crops have failed, and little increase over last year is expected. If these views prove correct, an increase of 200,000 to 400,000 bales may be expected in 1865 over the past year; the import may range from 2,800,000 to 3,000,000 bales, against 2,587,000 bales for 1864, 1,932,000 bales for 1863, and 1,445,000 bales for 1862—the year of smallest supply. The home consumption the past year has taken off 1,606,000 bales, and the export 732,000 bales, being together 248,000 bales less than the import, and this amount has gone to increase our stocks. The problem is, whether the trade and export will take off half-a-million bales more in 1865 at the present scale of prices; otherwise there is likely to be another considerable addition to stock at the close of 1865. That the loss of profit to Lancashire in the last few years has been enormous can be seen at a glance from the small margin that now exists between the aggregate value of the raw material consumed and the manufactured article produced, as compared with former years. Taking the Board of Trade returns of the export of cotton goods and yarn for the last five years, and adding to them an estimate of the amount consumed at home, which we will take as one-third the exports, we obtain a rough approximation to the whole value of the cotton manufactures of Great Britain. If we deduct from this the price paid by our spinners for the raw material consumed, we obtain the amount of profit which the internal industry of the country reaps from the trade. In 1860 a sum of forty millions was distributed among the industrious population of Lancashire, engaged in the cotton trade or the branches dependent upon it. During the last three years this amount has declined to about one-half. Of course there are many modifying circumstances which might be mentioned, such as the profit made upon old stocks held when the war commenced. But again it must be remembered that the exports of 1861 and 1862 were greatly swollen by the shipments of these stocks, and represent more than the real production for these years. Taking all into account, and making allowance for 1860 being a year of remarkable prosperity, it seems fair to assume that the manufacturing industry of Lancashire has suffered to the extent of fifteen millions per annum or more for the last four years, in consequence of the stoppage of the cotton trade with the Southern States, and it is evident that if this exhausting drain upon its capital continues for another year or two, serious consequences must follow in the shape of commercial embarrassment and want of credit.

Colonies.

New Zealand Fish.—It is well worth the while of the Provincial Council to consider whether it is not necessary to enact some measure for regulating the fisheries of this province (Otago). It is a singular anomaly, that whilst, on the one hand, money is voted for the introduction of new varieties of fish, on the other hand the most wanton destruction of valuable native kind is being tacitly permitted. We might refer to one species of fish alone which is rapidly becoming scarce in this harbour, viz., flounders. The flounder, when in good condition, is a really excellent and valuable fish, but it is rarely now that one can get a full-grown fish; instead of which the fishermen send to market a number of little fry, hardly worth the trouble of cooking. The other day some barrels of fish were being landed from the port steamer, and the contents of two of them consisted entirely of very small flounders, little bigger than sardines. If the reckless

capture of fish, in season and out of season, be permitted to continue, there will very soon be nothing but the deep sea varieties left.

Publications Issued.

THE BOOK OF PERFUMES. By Eugene Rimmel. (*Chapman and Hall.*) This is a curious and interesting work, the origin of which appears to have been the author's labours to instruct and inform the members of the Society of Arts. "Four years ago," observes Mr. Rimmel, "I had to prepare for the Society of Arts a paper on 'The Art of Perfumery, its History and Commercial Development,' and, to qualify myself for the task, I had to devour a huge pile of big books in order to ascertain through what mysterious arts the ancients ministered to the gratification of their olfactory sense, and to the embellishment of the human face divine. Two years later I was called upon to form part of the Jury at the Great Exhibition, and to draw up the official report of the perfumery class. The researches I had to make on the former occasion, and the observations I gathered on the latter, gave me a complete insight into the world of 'sweet smells,' both ancient and modern." Thinking that the notes he had thus collected, combined with the results of his experience as a practical perfumer, and of his rambles in foreign lands, might prove interesting to some, he has given them to the world in this digested form. After devoting a few pages to the physiology of odours in general, he traces the history of perfumes and cosmetics from the earliest times to the present period. He then briefly describes the various modes in use for extracting the aroma from plants and flowers, and concludes with a summary of the various fragrant materials used in the manufacture. A large number of quaint and characteristic illustrations embellish the work, which will possess an interest for many.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Geographical, 8½. 1. Mr. J. G. Taylor, "Visit to the Sources of the Tigris and Euphrates." 2. Mr. M. A. Abramof, "Lake Nor Tzai-san, and its Neighbourhood."
British Architects, 8.
Medical, 8.

TUES. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Renewed Discussion upon Mr. Joseph Taylor's Paper "On the River Tees."
Zoological, 9.
Syro-Egyptian, 7½. Mr. D. W. Nash, "On the Monumental Lists of Egyptian Kings."
Ethnological, 8. 1. M. Khanikof, "Contributions to the Natural History of the Iranians." 2. Sir Woodbine Parish, "On the Artificial Eyes of Certain Peruvian Mummies." 3. The Duc de Roussillon, "On the Scythians." 4. Mr. Wallace, "On Civilisation in North Celebes."

WED. ...Geological, 8. 1. Rev. P. B. Brodie, "On the Lias Outliers at Knowle and Wooton Wawen in South Warwickshire." 2. Mr. T. F. Jameison, "On the History of the last Geological Changes in Scotland." 3. Mr. Julius Haast, "On the Excavation of Valleys by Ice."
Graphic, 8.
Microscopical, 8. Mr. H. J. Slack, "On the Vinegar Plant."
Literary Fund, 3.
Archæological Assoc., 8½.

THURS...Royal, 8½.
Antiquaries, 8.
R. Society Club, 6.

FRI.......Astronomical, 8.

SAT.......R. Botanic, 3¾.

Patents.

From Commissioners of Patents Journal, December 30th.

GRANTS OF PROVISIONAL PROTECTION.

Archers, construction of bows used by—3058—J. Norton.
Atmospheric railway breaks and communications—3083—C. Rendall.
Boots and shoes, manufacture of—3041—W. Clark.
Bottles, jars, &c., construction of—3010—E. Bevan and A. Fleming.
Capstans, apparatus for working—3089—G. Elliott.
Carriages, apparatus for retarding and stopping—3066—T. H. Roberts.
Cigars, pipes, &c., materials for the lighting of—2943—R. A. Brooman.
Cigars, snuffs, &c., preparing tobacco for—3070—L. Morgenthau.
Closets and commodes—3121—J. White.
Coal plates, &c., method of securing—3104—S. Hood.
Comb—3014—R. A. Brooman.
Cooling and freezing, apparatus for—3062—R. A. Brooman.
Cotton, roller gins for ginning or cleaning—3090—E. W. Otway.
Crinolines, dresses, &c., manufacture of—2062—F. Kreuz.
Double suction pump—3155—H. Druneau and P. Laidet, sen.
Elastic substances, machinery for pressing—3181—C. G. Wilson.
Electric insulation—3092—C. Hancock and S. W. Silver.
Fibrous materials, machinery for spinning—3163—J. P. y Llag
Fire-arms, breech-loading—3159—T. A. Grimston.
Fluids, engines for compressing and measuring—3171—J. Ramsbottom and T. Blackburn.
Gases, &c., regulating the flow of—3030—T. Atkins.
Glass maker's pots, construction of—3082—R. H. Johnson.
Hats, manufacture of—3129—F. Cooke.
Hydraulic presses, &c., mode of working—3173—L. R. Bodmer.
Knives, cleaning and polishing—3106—G. Kent.
Laces, braids, &c., apparatus for making—3151—E. T. Hughes.
Liquids and gases, raising and drawing off—3127—J. G. Tongue.
Liquorice cakes, &c.—3098—W. Wharldall.
Looped fabrics, manufacture of—3123—W. Cotton.
Machinery, straps for driving—3125—M. J. Haines.
Mills for grinding corn, &c.—3135—F. Price.
Ornamenting fabrics—3076—R. A. Brooman.
Parchment, preparation of the surface of—3117—S. W. Hooper.
Paving, system of—2974—V. Gache.
Photographic apparatus—3175—J. H. Johnson.
Ploughs—3141—J. A. Hopkins and C. Culpin.
Rails or trams—3137—Z. Eastman.
Railway brakes, apparatus employed for actuating—3006—W. Clark.
Railway carriages, &c., facilitating the starting of—3064—J. H. Johnson.
Railways, traction on—3060—C. Crockford.
Rosin, purification of—3080—F. G. Mulholland.
Ruffles, frills, &c.—3096—H. Taylor.
Sanatory toilet apparatus—2808—W. E. Gedge.
Sawing machinery—3078—R. Mathers.
Sheets and surfaces for designs—3094—C. Hancock and S. W. Silver.
Ships, compositions for coating—3147—H. F. McKillop.
Solar time-pieces—3088—A. V. Newton.
Steam boilers, &c., injecting tallow into—3056—H. Wilson.
Steam engines—3139—H. Davey.
Stone, &c., preserving and ornamenting—3084—R. A. Brooman.
Thermometers—3086—W. H. Cullingford.
Vessels, &c., lifting shot to the fighting deck of—3149—Sir F. Blackwood.
Walls, pavements, &c., decoration of—3113—W. Clark.
Watches, &c., construction of—3100—J. G. Tongue.
Wire rods and wire, apparatus for rolling—2195—G. Bedson.

INVENTION WITH COMPLETE SPECIFICATION FILED.

Douches and injections, apparatus for administering—3215—W. E. Gedge.

From Commissioners of Patents Journal, January 4th.

PATENTS SEALED.

1585. E. R. Turner & F. Turner.	1702. J. Middleton & J. Conlong
1664. H. Messer.	1707. R. A. Brooman.
1665. R. K. Aitchison.	1712. J. Webster.
1666. D. Blake.	1721. W. E. Gedge.
1668. W. Lloyd.	1727. S. Carey
1670. B. Whitehouse and C. Priestland.	1729. L. Schad.
1671. J. E. Wilson.	1735. A. Bosch.
1673. J. E. Wilson.	1756. R. Smith and J. Booth.
1674. E. Clifton.	1802. T. Bourne.
1675. J. B. Howell.	1804. H. E. F. de Briou.
1678. E. R. and C. Ainsworth.	1830. E. Snell and G. Allibon.
1682. J. Spencer.	1891. P. E. Fontenay.
1683. J. M. Marsden.	1920. J. H. Johnson.
1684. H. E. Skinner.	1937. B. O'Connor.
1687. H. Crichley.	2040. A. V. Newton.
1691. J. Wilson.	2137. J. Stenhouse.
1693. E. H. Carbutt & W. Cutts.	2319. J. H. Johnson.
1695. A. Blake.	2351. W. Whittle.
1696. E. J. Dixon.	2463. F. W. Shields.
1697. C. A. Bamlett.	2747. J. D. Young.
1698. G. Russell.	2759. W. E. Newton and E. C. Shepard.
1701. A. Rogers.	2819. C. Martin.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

3240. W. Turner and J. W. Gibson.	13. W. B. Patric.
	23. H. Eschwege.
3243. T. W. Atlee.	3268. J. Haslam.
3260. W. Tongue.	3275. R. A. Brooman.

Registered Designs.

Improved Speaking Tube—Dec. 16—4681—John Waldram, 4, Godfrey-row, Shaklewell-green, N.E.
Dry Gas Meter Case—Dec. 17—4682—Henry Alder, The Grange Meter Works, Edinburgh.

THE

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AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, JANUARY 13, 1865. [No. 634. VOL. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

CANTOR LECTURES.

"ON THE REPRODUCTION OF NATURAL FORMS BY ART AND MANUFACTURE." By B. WATERHOUSE HAWKINS, ESQ., F.G.S., F.L.S.

Mr. Hawkins will resume his Course, on Monday Evenings, as follows:—

JAN. 16TH.—LECTURE III.—On the varieties of artistic treatment of the forms of animal and vegetable life—pictorial representation; conventional ornamental, allegorical, and symbolic combinations of animal forms.

JAN. 23RD.—LECTURE IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

JAN. 30TH.—LECTURE V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra-Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. A set of tickets for this purpose has been sent to every member.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

JAN. 18.—"On the Best Mode of Applying Power to Propel Trains, on the Metropolitan and other Railways having Frequent Stations, and in Terminal Stations." By PETER W. BARLOW, Esq., F.R.S.

JAN. 25.—"On the Best Mode of Protecting London from the Ravages of Fire." By CHAS. F. T. YOUNG, Esq., C.E.

FEB. 1.—"On London Sewage, from the Agricultural Point of View." By J. CHALMERS MORTON, Esq.

TECHNICAL TRAINING OF ARTIZANS.

The following letter has been addressed to the Chairman of the Council by Mr. Twining, one of the Vice-Presidents of the Society:—

SIR,—As it is partly owing to the encouragement which yourself, as well as Mr. Chester and others of my colleagues, have given me, that I have been induced to pursue further the subject of the Technical Training of Artizans, I feel that I need scarcely apologise for submitting to you a brief report of the progress which I have made.

The desirableness of providing for our artisans facilities for the perfecting and testing of their technical knowledge and efficiency equal to those enjoyed by their continental brethren, is impressively expounded in Mr. Davenport's very able paper, and he has clearly shown that it is the province of the Society of Arts to take the lead in a national movement for that purpose. I feel myself called upon, whilst expressing my concurrence with these views, to show that my own objects would perfectly harmonize with them.

My chief object is for the present to induce and enable the Society of Arts to make the experiment of holding, in addition to its Annual General Examinations, Technical Examinations for testing the abilities of certain classes of workmen, hereinafter described, and of granting certificates of competency which may be useful to them, and offer a desirable guarantee to the public.

The following are among the preparatory steps which I have taken:—

I have obtained, through the kindness of my continental friends, a considerable amount of interesting information, in addition to that already published in England, concerning the Industrial Institutions and Trades Regulations of various parts of Europe. The whole is now in the hands of Mr. Iselin, who had undertaken to prepare a digest or synopsis, bringing into relief everything likely to be of useful application in this country. I regret that its completion is inevitably retarded by Mr. Iselin's engagements in connexion with the Dublin Exhibition.

It was desirable to ascertain what books and other materials for technical instruction exist and come sufficiently within the scope of the proposed Examinations to be of service as text-books. I have got together nearly all the small handbooks of the kind published of late years in

England, and, finding that scarcely any would answer our purpose, I have procured from Paris a selection of the best French publications of this description. The whole of the collection, amounting to seventy-eight volumes, is deposited at the Society of Arts. I intend getting one or two suggestive specimens of text-books, specially suited to our requirements, prepared by competent authors. Some of them, of which a sketch is already prepared, will embrace, for the use of several trades in common, those elements of scientific knowledge which several require, whilst others will offer for each trade in particular that technical information which specially appertains to it.

It would be now premature to publish a detailed account of the proposed Examinations, but it may be well to state at once that I do not think of interfering with art-workmen, whose attainments can be sufficiently tested by exhibitions, whilst the subject of their training is already in good hands; nor do I intend including the higher class of foremen of manufactures, or the lower class of factory hands. The first experiment would, indeed, be restricted to a few select handicrafts and technical trades, involving knowledge susceptible of being satisfactorily tested, and the acquisition of which wants encouragement.

The success of our manufacturing industry proves that English workmen possess qualities of mind, and a temperament of body, which peculiarly suit them for discharging regularly and efficiently, under the guidance of intelligent foremen and enterprising manufacturers, a definite task assigned to them in the routine of factory work, and mostly involving neither science, art, nor origination. The case is different with the tradesman or mechanic who is expected to turn a ready hand to the various duties of a complex handicraft, and who must rely on his own knowledge and ingenuity for helping himself or for serving his employer. Here we too frequently find shortcomings as to technical knowledge and practical intelligence, which occasion waste of expenditure, annoyance, and discomfort to the public, whilst they entail unnecessary trouble, and oftentimes injury to health or limb on the artizan himself. This is by no means to be wondered at, considering on the one hand the lax system of technical training which has hitherto generally prevailed, and, on the other hand, the absence, among a large portion of the work payers, of that scientific knowledge which would make them alive to, and impatient of, the ignorance of those whom they employ.

Now, in several parts of the Continent, a system of examinations prevails calculated to secure the public, in a great measure, against inefficiency on the part of the artizans they may have occasion to employ, by maintaining among them definite standards of technical knowledge and manual ability, according to their position as subordinate workmen or masters in trade.

The following is an extract from a letter received from a friend in Germany, well acquainted with the manufacturing and commercial industry of that country:—"I enclose an abstract of the law in Prussia concerning the exercise of trades and handicrafts. . . . . It is in full practice, and nobody thinks of abolishing it; indeed, it works admirably, and the public are certain to be served by men who understand their trade. In your country any person can commence a trade, whilst in ours he must first show that he has the necessary capacity and knowledge for its successful exercise."

What I propose to adopt is the principle of examinations as a test for and an incentive to efficiency, but certainly not the regulations which in Germany render them compulsory. The Society of Arts Technical Examinations would, of course, be as voluntary as its Examinations in General Knowledge. They would offer benefits without trammels, and care would be taken that they should not unduly interfere with the usages, or even with the prejudices of industrial trades, whose credit and advantage they would, in fact, serve no less than the interests of the work-employing public. I feel confident that if this plan should be adopted, the young artizan would see more clearly defined what he *must* know and what he *ought* to know. Facilities for acquiring knowledge would be placed before him, together with a prospect of distinction and well-paid employment if he made good use of them; and technical efficiency, being thus rendered a good marketable commodity, would be sure to prosper in this land of pounds, shillings, and pence.

The class of candidates whom we should have chiefly to deal with would differ widely from those who come up to the Society of Arts General Examinations, as to aptitude for receiving instruction, as to the nature of the instruction which they would require, and, consequently, as to the suitable mode of testing it. I believe that in most cases it would be best to imitate the German system and that of the Pharmaceutical Society of London, and to hold for each trade a minor and major examination. The minor would correspond to the denomination of journeymen, companions, or mates, and the major to the denomination of accomplished workmen or masters in trade. For each of these examinations there should be three classes of certificates, marking—Competency, Ability, and Excellency. If our operations obtained general recognition, journeymen or mates would find hereafter that to make their way in the world they ought to be able to show, at least, a third-class minor certificate, whilst a first-class major certificate would secure to any man a high standing in his trade.

A mere glance at the educational condition of our second-class workmen will show that the minor examinations could not be carried on by written papers, and would have to be conducted orally, even if this were not rendered necessary by the nature of the questions to be put to the candidates, frequently involving actual practice at the recognition of articles and adulterations, the display of manual ability, &c. In these matters again we could not do better than follow the Pharmaceutical Society, as also in holding the major examinations partly orally and partly by means of printed forms and written answers.

Lectures and classes would be very useful for the preparation of candidates; but this and other similar points, to which it is unnecessary to advert at present, can best be settled when the measures shall have been determined which the Council may be inclined to adopt in the direction mentioned in Mr. Davenport's valuable memorandum. As regards the financial point of view, I may state my willingness to defray, not only the preparation of the text books required, but also the examination fees for the first experiment.—I remain, &c., T. Twining.

Proceedings of Institutions.

Bacup Mechanics' Institution.—On the 3rd January, the 26th Annual Soirée of this Institution was held, when the spacious hall was crowded in every part. After tea, to which about 700 sat down, the Venerable President, Lawrence Heyworth, Esq., opened the proceedings, and took the opportunity to present several books to the society. The secretary's report stated that the finances were in a healthy state, there being a balance in hand of £12 10s. The number of members on the books had averaged 245 per quarter. Ninety volumes had been added to the library, and an increase had taken place in the issue of volumes to the members, the total having been 7,038, or an average of 41 to each member. The increase in attendance at the evening classes has been considerable. In efficiency, as tested by the local Society of Arts, Science and Art, East Lancashire, and Lancashire and Cheshire Union Examinations, the school has made decided progress. A great many prizes and certificates have been obtained by the scholars. It is a source of regret that in some of these examinations the candidates are almost entirely from the younger members of the classes, while elder ones make no attempt to compete in them.

The establishment of the Science Classes, in which Chemistry and Physiology are taught, has been attended with the best results, and has given a *status* to the Institution which it otherwise could not have obtained. The evening was enlivened by some excellent songs and music and a Christmas entertainment; and speeches were made by the following gentlemen:—Alexander Mackie, Esq., of Warrington; the Rev. J. A. Shrewsbury, of Manchester; the Revs. M. Johnson and T. Lawson, of Bacup; John Dawson, Esq.; Capt. Aitken, the Chairman, and several other gentlemen in the neighbourhood.

DUBLIN INTERNATIONAL EXHIBITION.

Besides the official patronage extended to the undertaking, Her Majesty has further evinced her interest in the Dublin International Exhibition, by consenting to lend from her collection pictures by the following painters:—Wilkie, Mulready, Stanfield, Roberts, and Thomas. The Fine Arts Committee, presided over by Viscount Powerscourt, has been very successful in obtaining the loan of choice and valuable works; and Sir J. J. Coghill, Bart., one of the committee, is coming over to England to select other pictures from the collections of noblemen and gentlemen who have expressed their disposition to lend works.

The British Colonies, although labouring under disadvantages from the short notice given them and the difficulty of obtaining legislative grants so soon after the last London Exhibition, will be very fairly represented by small but interesting collections of produce and manufactures. The Australasian Colonies will have collections of their wools, wines, fibres, silk, woods, oils, cotton, grain, arrowroot, minerals, and objects of natural history, and even some illustrations of fine arts in photographs and pictures. India will show a magnificent collection of raw products and rich manufactures, arranged by Dr. Forbes Watson, of the India Museum. Ceylon sends carved wood tables, a fine collection of fibres and ropes, gums, oils, grains, and pharmaceutical products. Malta will show the carved stonework, silver filigree, and the fine lace for which she is so famous, with probably mosaic work and other articles. The North American Colonies are making some preparations to be represented. Several of the West India islands send furniture, cotton, and other fibres, objects of natural history, shell work, pimento, coffee wood, and other walking sticks, which have recently risen into a large and profitable trade, besides samples of those staple products which are the mainstay of their industry. Lagos, Sierra Leone, and other West African Colonies, will make a fine display of native mats and basket work, country cloths, native curiosities, carved calabashes, and articles of produce. Most of the African merchants and companies have promised their aid in contributions. Other Colonies will contribute produce and miscellaneous objects of various kinds.

ENGRAVING AND OTHER REPRODUCTIVE ART PROCESSES.

By S. T. Davenport, Esq.

To the antiquity of the art of engraving it is not my intention to do more than allude; it is abundantly evident that it was known to the Egyptians, and used long prior to the Christian period. The art was probably one which grew out of the necessity of attaching some distinguishing mark to individual works, or from the custom of recording the history of the early ages by cutting them in stone, many examples of which have been preserved to us. Soft bodies were also impressed with the maker's marks, as in the case of ancient bricks and other plastic bodies; and thus, what was in the first instance an isolated mark, led to and became a reproductive art. From a sculptured or monumental art a refined art grew up, of which, and the perfection to which it attained at an extremely early date, the engraved gems and seals preserved in our museums give ample evidence. Engraving on metal was early employed as a means of ornamenting articles of dress; and the coins preserved to us show how the skill of the die-sinker and engraver in metal became the basis of another reproductive art. Engraved metal plates have been found in the coffins of mummies, and are preserved in the British Museum. In India engraving on plates of copper appears to have been practised long prior to the Christian period. It was there customary to ratify grants of land by deeds of transfer actually engraved on copper, and a copy of one such relic, with an English translation, is given by Mr. Wilkins, in the 1st vol. of the "Asiatic Researches," page 123,—an early proof of the commercial use of engraving. To trace the history of engraving on stone and metal to the period when the art of printing was discovered, would only be to repeat an oft-told tale, and tend to prove that the one object which all appear to have had in view has been to facilitate the means of reproducing, at a cheaper rate and by a more ready means, copies of the works of the artist and engraver. It has appeared to me that the present is not an inopportune time for reviewing some of the changes which have been either introduced, or proposed for introduction, during the last half-century, and which have placed us in our present position with reference to the art of engraving, or its substitutes, for illustrative commercial art purposes. With a view, however, of making what I have to say more clear, it is necessary that I should state what were the peculiarities of the art processes in common use prior to the beginning of the present century. The earliest specimens of prints from engravings were those obtained from wood blocks on which the design was cut in relief, but the art of engraving on wood, though greatly improved, continued in an extremely imperfect state till within the last half-century. The perfection to which the art had attained in the year 1803, may be ascertained by a reference to Vol. xxi. of the Transactions of the Society of Arts, in which is printed a specimen showing the great progress which the art had made at that date; and at page 13 of the Preface we find the following:—"It has been frequently asserted that the art of engraving on wood is not, at the present day, equal to what has been done by some of the ancient masters, but when the emblematical performance of young Austin in this line, prefixed to the present list of premiums, is considered as the work of so young an artist, it may probably appear that it cannot be excelled by many artists in Europe of a similar age, and the reward assigned is likely to excite his emulation to progressive improvements in that art." The reward given was the silver medal and ten guineas—and the block was for many years used by the Society as a specimen of the art, and was printed at the head of the Secretary's letter announcing the election of new members. The art was, however, carried to considerable perfection by Bewick, who applied it in the illustration of his "Natural History of Beasts and Birds," and the commercial condition of wood engraving may be seen by a reference to that work. The earliest specimen of a print from a wood block is one known as the St. Christopher, and is dated 1423.

The earliest use of engraved metal plates in England probably dates from the time of the Conquest, but Mr. Strutt states that he has not seen any with a date prior to 1284. They were then used as monumental brasses or tablets, and were executed with the graver, and are assumed to have been produced by ecclesiastics. The same principle which was applicable to the production of monumental brasses, viz., the removal of a portion of the surface of a metal plate by cutting it away, according to any desired design, by means of the graver, was applied by goldsmiths in the production of Niello work. The earliest known print from a metal plate is one which can be seen at the Imperial Library, Paris; it is attributed to Tomaso Feneguerra, the Florentine goldsmith, and bears the date 1452, and the earliest known book illustrated in this way bears date 1478, and

was printed at Rome. The next step in the improvement of the art of engraving is said to have taken place at the beginning of the sixteenth century, and is attributed to Albert Dürer, to whom is ascribed the invention of the art of etching, or drawing with a metal point or tracer, upon a plate, the surface of which was covered with wax or varnish; and the etching or drawing being afterwards permanently engraved in the metal plate by the action of acid. The process of etching afforded an opportunity of exercising any required amount of freedom of hand in the production of foliage or landscape, and soon led to a combination of the two processes, and was the means by which engraved copper-plates were usually produced at the beginning of the present century. This process is known as line engraving; it is a slow, tedious, and costly means of copying works of art; its peculiarity is, that it affords facility for giving a large amount of drawing and minuteness of detail, at the same time that it admits of the greatest possible gradation of light and shadow, and the most perfect artistic effect. The process of etching was largely used by Rembrandt. The most perfect works executed in the early days of this art are, however, to be found in the portraits and historical subjects, for the reproduction of which it was especially suited, though in later times it was largely and most effectively employed in the copying of architectural, monumental, and landscape art. Copper-plate engravings were printed in England, in "Vesalius's Anatomy," as early as 1545, but the English school of engraving cannot be said to have existed till about the middle of the eighteenth century, at which period efforts were made to advance the interests of artists in this country. It was during the reign of George the Third that the Royal Academy was established, and as art advanced, so with its advancement grew up the use by our artists of the etching point and the graver in a more refined and skilful manner. But the mere reproduction of copies of pictures from engraved plates printed in black inks did not long continue to satisfy the public, and efforts were soon made to print in colours from these engraved plates, but no thoroughly satisfactory results were obtained from line engravings in this direction, and recourse was had to the next process, to which I shall call attention.

Line engravings were executed (as before stated) by cutting away the surface of the copper-plate by means of the graver, which, for this purpose, was made concave in its length, and varied from a square to a thin V-shape in its width, thus enabling either a narrow or a broad line to be cut, while by a slight variation of pressure, or by depressing the hand of the operator, the point of the graver was gradually driven along the metal or freed from the plate altogether.

Chalk or Stippled Engraving, the next process to which I have to refer, was, on the contrary, executed by means of a graver of an arched or convex form, which when applied to the copper-plate could not relieve itself from the surface of the metal, the whole tendency, wherever pressure was applied, being to thrust itself deeper and deeper into the metal, leaving a punctured dot, varying in breadth or delicacy according as the graver itself was more or less square or V-shaped on its face. This mode of puncturing the face of a metal plate was known as "chalk engraving," from the clusters of dots being so arranged as to imitate the granulated effect of lines drawn upon cartridge paper with Italian chalk. This process was especially suited to portraiture, or groups of statuary, owing to the softness of its gradations from light to shadow, and the production of an equal grain over the entire surface of a piece of metal. It was ill-adapted, however, to the production of landscape effects.

The Mezzo-tinto is a method of engraving, the discovery of which is attributed to Prince Rupert, and it may not be uninteresting to quote the following letter by Dr. Diamond, which was communicated by him to the Society of Antiquaries in 1838, and to which is appended a catalogue of the earliest known works in mezzotinto. The catalogue will be found in vol. xxvii., pages 405 to 409, of the Archæologia.

To Sir Henry Ellis, K.H., F.R.S., Secretary of the Society of Antiquaries.

"Dear Sir,—In the last session I had the honour of laying before the Society of Antiquaries, several remarkable specimens of early mezzotinto engraving, which prove beyond doubt that the generally received opinion as to Prince Rupert being the inventor of that style of engraving is erroneous. From the examples then exhibited, it appears that the person to whom the merit of the invention is due, is Louis von Siegen (or *L. à* Siegen), a lieutenant-colonel in the service of the Landgrave of Hesse Cassel. The works of this amateur artist are of considerable rarity; and it is not improbable that they were merely distributed among his friends and patrons. Baron Heineken, in his 'Idée Générale d'une Collection complette d'Estampes,' printed at Leipsic, in 1771, says decidedly that Siegen was the inventor of mezzotinto engraving, and observes that the first specimen which appeared was the portrait of the Princess Amelia, Landgravine of Hesse; he adds, that Prince Rupert learnt the art from Siegen, and that eventually it became public. In the new edition of Granger's Biographical History of England we find some observations on the invention of this style of engraving:—'It should not be forgotten that Sir Christopher Wren is said to have been the inventor of mezzotinto; it is certain there is a Blackamoor's head by him in a different manner to that of Prince Rupert; also, Vertue, in a manuscript in my possession, mentions a large head *something like mezzotint*, of the Princess Amelia of Hesse, thus inscribed: 'ad vivum a se primùm depictam, novoque jam sculpturæ modo expressam, dicat consecratque L. à S. anno 1643.' Mr. Wanley says there is one of this lady in Lord Harley's collection of heads, also one of the Comes of Hesse by the same hand, who was the person who taught Prince Rupert.' Mr. Lodge, in his life of that prince contained in his Portraits of Illustrious Persons, after mentioning the prince's contributions to science, and various discoveries, says, 'But the discovery which we find most frequently associated with his name, is of the art of engraving in mezzotinto, the first hint of which is said to have occurred to him from observing the effect accidentally produced by a soldier scraping some rust off the barrel of his musquet; his right, however, to the strict reputation of inventor has been somewhat questioned, *but with little probability*.'

"It will be seen by this that Heineken's authority is doubted; but Mr. Strutt, in his 'Biographical Dictionary of Engravers,' although more cautious, is nevertheless in doubt on the subject; for he says, after noticing the story of Prince Rupert's observing the soldier scrape the rust from his musquet:—'If the account, as given by Baron Heineken, be allowed as authentic, and it bears every appearance of being true, especially *if such a portrait really exists*, then the probability of the first story is entirely destroyed. I must leave the reader, however, to decide, having given him all the information I could obtain on the subject.'

"Now, from the extracts given, it is evident that neither Strutt, Bryan, Granger, nor Noble have ever seen the engravings in question; and it is a remarkable fact, that not one of them is to be found in the fine collection of the British Museum. The example I have now the pleasure of exhibiting, is a portrait of the eldest daughter of Charles the First, inscribed: 'Augusta Maria Caroli: M: B: Reg: Filia. Princ: Aur. Sponsa.' and is of great rarity; one other only being known in England, namely, that in the collection of Mrs. Sutherland; which is, however, I am informed, very much injured.

"The present portrait, as a work of art, is curious from its combining two distinct styles of engraving; the figure being entirely mezzotinto, and the back-ground in line and 'cross-hatched.' The likeness is highly interesting from the strong resemblance which it bears to the Stuart family, especially to Charles the Second, and his brother, Frederick Duke of Glocester. Near the base of the picture in the right-hand corner are the words, 'Honthorst pinxit, L. à Siegen inv. [enit] et fecit;' and it is worthy of observation, that the word *Inventor* is generally found on the works of Siegen. On the Holy Family engraved by him after Caracci, and dedicated to Cardinal Mazarin, is the following remarkable inscription:—'Eminentissimo Domino D. Julio Mazarini S. R. E. Cardinali, &c. Novi hujus Sculpturæ modi *primus inventor* Ludovicus a Siegen humilissime offert, dicat et consecrat, Ao. 1657.'

"Huber, the compiler of Winckler's Catalogue, tells us that Theodore Caspar de Fürstenbergh, a Capitulary Canon of Mayence, was an engraver in mezzotinto; that his works are contemporary with those of Siegen, and expresses a doubt as to which was the disciple of the other; adding, if Fürstenbergh learnt the art of Siegen, he excelled his master. But there is no evidence whatever to warrant this doubt; on the contrary, the portrait of the Queen of Bohemia, which I exhibited in February last, bears the date of 1643, while the earliest known specimen of Fürstenbergh is dated 1656. It is only necessary to add that Rupert's earliest effort in mezzotinto (though etchings of this Prince are earlier, and one is known inscribed Rup. Pr. 1637) is of the year 1658. In conclusion, I subjoin a catalogue of the known works in mezzotinto of Siegen, Fürstenbergh, and Rupert, as the same has not to my knowledge ever been printed.

"I have the honour to remain, Sir Henry,

"Your obedient and humble servant,

"Hugh W. Diamond."

Louis von Seigen (or L. a Seignen), born 1820.

No. 1. The Virgin holding the infant Jesus. In front, on the right of her, is St. John; and behind, St. Joseph holding a book in one hand and a pair of spectacles in the other, after Caracci; with the inscription, "Eminentissimo Principi Domino D. Julio Mazarini S. R. E. Cardinali, etc. Novi hujus Sculpturæ modi *primus* inventor Ludovicus a Siegen humilissime offert, dicat et consecrat." Ao. 1667. (Height 13¼ inches, width 10⅞, without the inscription.)

2. Portrait of the Landgravine of Hesse with this inscription, "Amelia Elisabetha, D. G. Hassiæ Landgravia, etc. Comitissa Hanoviæ Muntzenb. Illustrissimo ac Celssimo Pr. & D'no, D'no Wilhelmo VI. D. G. Hassiæ Landgr. etc. hanc Serenissimæ Matris et Incomparabilis Heroinæ effigiem ad vivum à se primùm depictam novoq' jam Sculpturæ modo expressam, dedicat consecratq' L. à S. A'o D'nj. cIↃ. IↃ.CXLIII. (Height 17 inches, width 12¼.)

*** This is the portrait spoken of by the Baron Heineken.

I am also enabled, through the kindness of Dr. Diamond, to append the copy of a letter addressed by L. de Siegen to his Highness the Landgrave of Hesse-Cassel, and which I believe has never before been printed in this country, and appears to substantiate his claim to be recognised as the inventor of the mezzotinto art.

"To His Highness the Landgrave of Hesse Cassel.

"Serene and high-born Prince—Most gracious Lord,—In the same manner as my humble devotion, more than a consideration of reward, has brought me to your grace's service; though these services, however agreed by your grace, have been rather derogated by some persons, yet I have not relented in devoting to your grace my diligence, my labour, and my time, in proof of which I most humbly do present the present print to your princely grace.

"This is the copper print, most gracious Prince and Lord, which some time ago I mentioned to you to have executed, to your grace's mother's laudable commemoration, with a view to bring the said portrait into the possession of several persons of rank, acquainted with the illustrious deeds of this far-famed Princess.

"But having invented quite a new and hitherto an unknown proceeding, I have been enabled to print from the copper, not thousands (as from common plates), but only a few, owing to the subtlety of the workmanship, for which reason I have only a small number of copies to present.

"Of course I first of all make application to your princely grace, especially in dedicating the same to you, according to the inscription at the bottom, and for the following reasons:—

"The first, in remembrance of your mother, because the said object cannot be but most agreeable to your grace, as being the nearest, nay, the only son of the reigning Prince,

"For the second, because I dare not omit dedicating a work of art so rare and never heard of before, to such an extraordinary amateur of the fine arts as your grace is.

"No engraver or no artist will be able to imagine how this work could be done, because, as your grace is aware of, hitherto only three different species of workmanship are seen, namely,—

"First, line engraving, or cutting;

"Secondly, etching;

"Thirdly, a very uncommon manner, called the dotting manner, with points altogether, but different and very troublesome, and, therefore, not much in use.

"The present manner, however, is none of those, though also consisting of little dots without a single line, and though some parts have the appearance of lines, the whole is altogether stippled.

"I ought not to omit to state this for the guidance of such an experienced connoiseur as your grace is.

"Recommending your grace to the Divine Providence and welfare, I also recommend myself, remaining your grace's most true and humble servant,

"L. de Siegen.

"Amsterdam, 29th August, 1642."

The mezzotinto is a process altogether distinct from those previously mentioned, and was effected in the first place by puncturing or breaking up a uniform burr over the entire face of a copper plate, from which, if a print were taken, an impression in density of colour would be obtained equal to that required in the darkest parts of the picture to be copied. Upon this ground the subject to be engraved was traced, and by scraping and burnishing away the burr or dotted surface impressed in the face of the plate, either in part or wholly, the necessary gradations of light and shadow were obtained. This process, although affording facilities for covering large surfaces, did not admit of being applied on a small scale, so as to give detail of drawing or delicacy of outline, and was in the main inapplicable to the production of foliage, and when first practised was grey in colour and flat in effect. At a later period, with the view of facilitating the operations of the engraver, an instrument called a roulet was invented, and was used for the purpose of impressing a series of dots into the metal.

The first person who applied the mezzotinto process on steel was Mr. T. Lupton, who, in 1822, submitted a specimen of his work to the Society of Arts, and stated that in order to obtain the necessary ground on the steel plate he had been obliged to lay his ways in 80 or 90 directions, whereas in preparing or breaking up the surface of a copper plate from 24 to 40 ways were all that were required. The use of steel necessitated a much stronger hand and an increased number of ways in laying the ground, but the advantage of steel over copper was that from eight to ten times the number of prints could be taken.

Aqua-tinta, a process of engraving which was extensively used at the beginning of the present century, but which

is now rarely employed, was executed by a process of the following description:—The surface of the plate of metal to be engraved was equally covered with a finely powdered resin. The plate was then warmed, to attach the grains to the surface of the metal. A tracing of the design to be engraved was laid upon the resin, and the surface of the plate, after the whites had been stopped out, was submitted to the corroding action of acid, which, acting between the grains of resin, produced a granulation in the face of the metal plate. The light parts of the design were next stopped out, when the acid corrosion had been carried far enough. The darker parts of the design were again submitted to the action of acid, and this process was repeated till all the gradations from light to shadow, required by the design, were produced in the metal. A slight amount of burnishing and scraping of the plate so bitten in was then resorted to, to blend the several parts of the picture, and to heighten the lights where necessary. This process was carried to great perfection by Mr. Sandby about 1799. Such were the various processes in general use at the beginning of the present century, the whole being originally executed in copper. A growing demand for book illustrations, and a necessity for producing the engraving in a more durable metal, and one that would consequently yield a greater number of impressions, led to the introduction of the next process.

Steel and Machine Engraving.—The invention of steel engraving is due to Mr. Perkins, who first introduced the art in America; his object being to increase the facility, cheapen the cost, and produce absolute identity in the manufacture of bank notes. In order to effect this, he etched or engraved a steel plate, or, more properly, a block of soft steel, by the ordinary process of line engraving. The plate or block was then hardened. A cylinder of very soft steel, of from two to three inches in diameter, was then rolled backwards and forwards under pressure on the surface of the steel plate, until an impression from the engraving was obtained in relief on the face of the cylinder. The cylinder so obtained was in its turn case-hardened, and by rolling the hardened die over the surface of a flat plate of copper or soft steel, an exact copy of the original engraved plate, with all its sharpness, was secured. This process being repeated, any desired number of plates could be obtained from the die. As the object first sought was the production of bank notes, and the cost of elaborate designs was great, a machine was invented in America by Mr. Asa Spencer, which was called a geometric lathe, and this was employed in the production of geometrical figures in combination with line engravings, as borders and ornaments on the face and back of notes. Mr. Perkins brought his invention to this country, where it was introduced and known as the "sederographic" process for multiplying copies of engravings. Soon after his arrival in this country he was joined in working his process by Mr. Heath, and they state, in 1821, "we cannot yet say how long a well hardened steel plate will last, having never printed more than 500,000 impressions from the same plate. It should, however, be observed that this plate consisted principally of writing, or work quite as strong. It may also be observed that the impressions are yet good." The first steel plate engraved in this country is attributed to Mr. Raimbach, who was soon afterwards followed by the chairman of the Fine Arts Committee of the Society of Arts, Mr. Charles Warren. Engraving on steel, beyond necessitating a change in the nature of the acids used, and a better and more perfect graver, involved but little alteration in the process of engraving itself. Steel plates yielded a much larger number of impressions, but they also demanded more time in their execution, and, as a consequence, a higher rate of remuneration for their production; and thence arose a class of men whose works as artists gave fashion to the art of engraving and book illustration; and out of their labours came such works as "The Forget-me-not," "The Keepsake," "The Book of Beauties," &c., &c., coupled with which works are the names of the Findens, Charles Heath, Rolls, Lacy, the Le Keuxs, Goodall, Wilmore, Doo, and others, a school of engravers which has now entirely passed away. With the extended use of steel, however, came a proportionately heavy charge for printing, which, where large numbers were required, it was desirable to reduce as far as possible. This charge was not material as affecting high-priced works, but a considerable demand for illustrated books having arisen, a readier and cheaper means of illustration was required. We accordingly find that "Hone's Every-day Book" and "The Penny Magazine," which were popular works, and amongst the earliest examples of cheap literature, were illustrated with wood engravings, which, being produced in relief and capable of being printed with the type, saved the ordinary extra charge due to printing from steel plates. But, however artistic and effective wood blocks were, they lacked the refinement of the steel engraving. Concurrently with this spread of art in England, came the opening of the American, and the creation of an Australian market for English literature, and the adoption of a German discovery, which has done more to revolutionise art in this country than any other previously introduced, viz., the invention of lithography by Alois Senefelder, who, about 1795, while in search for a cheap means of printing the pieces which as a dramatist he produced, by an accident discovered that by writing on a slab of Kelheim stone, with ink prepared with wax, soap, and lamp black, and then biting in the stone with *aqua-fortis*, a surface in relief could be obtained, from which prints could be taken almost as easily as from wood blocks. This discovery led to the art of lithography as now practised. To the growth of the lithographic art I shall return hereafter, but for the present I would merely say that its introduction, and the great cost, as well as the time involved in printing from steel or copper plates, led to numerous attempts to cheapen the cost of engraved plates, and also to multiply the plates when produced. The process introduced by Mr. Perkins was inapplicable to large surfaces, both on account of cost, and the difficulty and risk of injury in applying it. But machinery had been applied in the form of the geometric lathe, and a desire was created to possess a machine of a simpler character which might be employed to produce skies and backgrounds in architectural subjects, as well as backgrounds to portraits, without involving the skilled, and in many cases monotonous labour of etching. This want was soon supplied by Mr. Lowry, who was speedily followed by Mr. Porter, Mr. Taylor, Mr. Storker, and others. By the first-named a machine was invented for ruling either straight or waved lines, which lines, when used separately, produced flat or graduated tints, and when used in combination produced the effect now so generally seen on the face of banker's cheques. Mr. Taylor's machine consisted of a square bed, upon which the plate to be ruled or engraved was laid, and over which a second bed was slidden or thrust. This bed was held in position by means of springs, which pressed against the inner side of a frame, over and attached to the upper and lower edges of the square bed of the machine. At the back or right-hand side of the machine was a solid block, to which was attached, on its centre, a female screw, in which worked a clamping screw. The motion of the machine was produced as follows:—A bar of iron, having at one end a pin fitted into a socket on the sliding bed, while its other end passed through a slot below the female screw plate on the back of the machine, and a clamping screw being brought down upon this bar, prevented the sliding bed being moved from its position until it was thrust forward by an index lever, placed at right angles to and connected with the iron bar. The degree of motion of the bed was then regulated by the distance through which the index lever was thrust, and this was determined by means of a screw-stop. Mr. Storker's machine had for its bed an inclined plane, over

which worked a second wedge-shaped bed, and the tint was ruled by gradually removing the thick end of the wedge from the centre or edge of the machine. In both cases, after motion had been given, to regulate the width of the lines to be ruled, a carriage, carrying a diamond point, was caused to travel above the face of the plate to be ruled, and the diamond being allowed to drop on to it, the line was drawn or etched. By substituting for the straight line in which the carriage travelled any required character of etched line, and causing the carriage carrying the diamond point to travel in it, a corresponding motion was communicated to the diamond, and the desired effect was thus mechanically obtained. But where lines were required to be ruled in perspective, the plate was fixed on a bed which revolved on a centre. The use of these and other similar machines was soon largely resorted to, and ultimately line engraving, as a commercial production, deteriorated; and in its place grew up a mere vulgar effect of light and shadow, the combined result of a set of lines ruled over the entire surface of a steel plate, and then acted upon by acid, as in the case of aquatint engraving. There were, however, other forms of machine engraving introduced, which have given rise to new industries, and continue still in use, such as the medallion engravings executed by Mr. Bacon's machines, in which a medal or modelled design was employed, and over the medal a tracer was made to travel, which varied in its direction from a straight to a curved line, in proportion as the surface was either flat or in relief. The background of the medal was represented in the engraving by a flat tint, while the high lights of the medal were produced by a widening of the lines, and the shadows by a comparative contraction of them. Modified forms of this machine are still in use, and have been applied to engrave rollers for printing calico and other fabrics. The result of these machine processes, coupled with the introduction of lithography, was to create serious competitors with the aquatint and mezzotint processes, which may be said to have been swept away by the great advance which lithography has made, to the consideration of which we will now return.

Lithography.—I have stated that Senefelder discovered, about the year 1795, the principle upon which lithography is based, but it was not till 1819 that much progress was made in the art; but at that date, owing to the fostering care of Baron Aretin, in Munich; Count Lasteyrie in Paris, and Mr. Rudolph Ackerman in London, an account of the art of lithography, showing its then state, appeared. The establishment of the art of lithography in England is, however, due to Mr. Hullmandel, who not only drew upon stone with crayons and printed from them in black ink, but soon carried out the process by drawing on two or three stones, and printed from them with ink of a neutral tint; he also drew on several stones, and printed from them in colours. Mr. Hullmandel introduced the process known as lithotint, the drawing being made upon the stone with a brush and liquid ink, and he also applied the process of stump drawing. The facilities which drawing with the crayon, the stump, and the brush, afforded for the production readily, and at a moderate cost, of a surface from which to print, soon gained for the art a large amount of public support, and enlisted the sympathies of the late Mr. Mulready, Mr. J. D. Harding, Mr. Louis Haghe, Mr. James Ward, Mr. J. Lane, and other Royal Academicians and artists, who applied themselves to the production of sketches on stone. There was, however, in the early attempts at lithography, a crudeness of effect and a want of gradation from light to shadow. To overcome this, Mr. Hullmandel made a material between ink and chalk, which, being applied to the hard edges, carried the full tints by gradation into the high lights. The effect thus obtained advanced the art in the estimation of artists, as it increased the facility for producing artistic effects, which was also greatly helped by the use of tinted paper and printing in neutral tints from several stones. Printing in colours was practised by Senefelder, but his early specimens give but a faint idea of the richness and beauty of the productions of Mr. Owen Jones, who applied himself to develope the powers of lithography, and who not only drew upon stone, but also printed in gold and colours the whole of his work illustrative of the Palace of the Alhambra. In addition to drawing on stone and printing in flat colours, he introduced a method of printing from graduated tints drawn in ink only upon the stone, graduating his tints by stippling upon polished stones with a fine camel hair pencil.

Litho-tinto is a method of drawing, in which washes of ink are applied to the surface of the stone, but it is not largely in use, though many artists have employed the process in the reproduction of their own sketches. The process of stump drawing by Mr. Hullmandel afforded great facilities for the production of even and graduated tints over the stone, and soon became a process in general use. The cost and inconvenient weight of the lithographic stone led to a desire to find a substitute, and for a large amount of commercial work drawing on zinc has been found to answer, and is now extensively in use. This fact leads me now to refer to the commercial, rather than the artistic use of lithography.

I have said that the discovery of lithography gave a means of printing from the surface in a manner similar to the process of printing from type or wood blocks, but owing to the slight relief of the drawing on the stone, and the necessity for wiping with a wet sponge, and gumming the surface of the stone to prevent the absorption into the stone of the grease from the ink, the process is nevertheless a tedious one, but this evil is in a measure compensated for, by the facility which the lithographic process affords for multiplying copies of a drawing when once made, by transferring an impression taken from the drawing first made to a second portion of the stone, and as this can be repeated to any extent, a number of copies can be printed at one operation—the only limit being the size of the stone, and the nature and size of the design to be printed. The want of an efficient substitute for steel and copper plates, in the form of a surface block from which to print with the type in ordinary type printing presses, still remains a desideratum, notwithstanding all that lithography has done, and the many attempts which have been made. Casts in relief from engraved copper plates were among the earliest efforts in this direction, but the cost and labour of producing a uniform surface fit for the printing press, has not hitherto led to a commercial success.

Electrotype.—We now come to a period in the history of engraving at which another new discovery was given to the world, and one which has since played an important part in the arts. I refer to the discovery of the process of electrotyping. In the year 1800, Volta, in a communication to the Royal Society, announced his discovery of the Voltaic pile. By its means Nicholson effected the decomposition of water and of several metallic salts. Cruickshank next invented the galvanic battery, to the positive poles of which he attached silver wires, the other ends of the wires being placed in a glass tube containing a solution of acetate of lead. When the electric current had passed through the solution for some time, metallic lead was found deposited on the negative pole. Brugnatelli observed the transfer of the elements of a decomposed compound from one pole to another. In 1801 Wollaston made the following observation, viz.: — That if a piece of silver, in connection with a positive metal, be put into a solution of copper, the silver is coated over with the copper, which copper will stand the operation of burnishing. It was not, however, till after the discovery by Daniel of his constant battery, in which copper is continually reduced upon the negative plate, that it was observed that the newly-deposited copper, when stripped off, had upon it a counterpart of every scratch on the plate upon which it was deposited. In 1837, Mr. Spencer, of Liverpool, discovered that if a portion of the surface

of the negative plate was covered with varnish, then no deposit took place upon those parts. He next conceived the idea of applying this process to the arts, by coating a piece of copper with varnish and wax, and cutting a design through it so as to leave the copper bare, and then depositing a metal upon these parts, so that on removing the varnish the design would be left in relief; but no account of these experiments was published till September, 1839. In May of that year it was announced in the *Athenæum* that Professor Jacobi, of St. Petersburgh, had discovered a method of converting any line, however fine, if engraved on copper, into a relief by a galvanic process. This announcement was followed by a letter from Mr. C. J. Jordan, which appeared in the *Mechanics' Magazine* in June of the same year; and it is due to Mr. Jordan to state that the suggestions he then made have since been acted upon with considerable success. Mr. Robert Murray next discovered that if the surfaces of plaster casts and similar non-conducting bodies were covered with plumbago or black-lead, it was no longer necessary to use metallic moulds, which had hitherto proved the great barrier to the progress of the electrotype art. Chemists and artists were not slow in their endeavours to apply this newly-discovered process as a means of multiplying copies of engraved plates, both of copper and steel. In the latter case, an impression was taken from the steel-plate, by covering it with a sheet of tin-foil, and passing it through the printing-press. The result was a print obtained in relief on metal. Upon this a deposit of copper was made of the required thickness, and the required plate from which to print was obtained. In the early experiments the plates were thin, and curled in printing; this defect was, however, soon overcome, and the practice of engraving in copper, where large plates were to be produced, as in the examples issued by the Art Union, was again soon reverted to, thus affording facilities which are now largely availed of, for multiplying copies of costly engravings at the same time that the quality of the works produced can be maintained against wear.

Glyphography.—The next application of the electrotype art to which it is necessary to refer, was that patented by Mr. Edward Palmer, and introduced under the title of "glyphography, or engraved drawings for printing at the type press after the manner of woodcuts." The process was a compound of drawing and engraving on a plate of copper, the surface of which, having been stained black, was then covered with a thin layer of a white opaque composition. A tracing of the design to be drawn or engraved was made. Needles, of various degrees of breadth and form, were then employed to remove the composition from the surface of the copper, beginning with the greatest breadths of shadow, and gradually working up to the lighter and more delicate parts of the design. When finished an electro deposit was taken from the drawing so made, and a block in relief was thus obtained, which, being mounted in the same manner as an ordinary stereotype plate, was capable of being worked in with the type, and printed from, in the machine and steam printing press. It is necessary to state that the composition on the face of the plate was extremely thin, and in order to obtain the required relief for a printing block, recourse was had to a secondary process for increasing the amount of relief in the blocks, and this was done to any desired extent. The specimens which Mr. Palmer presented to the world, of work produced by this process, left little to be desired so far as artistic effect was concerned; but as the process has not become general, I fear the cost of producing the blocks was not commercially economic. Among the artists who first applied this process may be mentioned Thomas Landseer, J. Bateman, W. S. Wilkinson, Alfred Crowquill, J. Fraser Redgrave, and W. H. Pain. This process is not so generally known as its merits and capabilities entitle it to be, and the problem of how to obtain with facility a substitute for the wood block still remains unsolved. Among the numerous other plans proposed for use in the production of engraved plates or blocks, may be mentioned voltatype, electro-tint, daguerreotype, and etching by galvanism.

Etching by Galvanism was suggested by Mr. Alfred Smee; it was similar to the ordinary process of etching, but instead of being bitten in by a direct acid action, Mr. Smee suggested that the etched plate should form the positive pole of a battery, and being dipped in a galvanic trough of sulphate of copper through which a current was passed, particles of copper would be given off from the etched lines of the engraving; the plate was to be removed from the bath from time to time, for the purpose of stopping out, and graduating the tints required, as in the usual etching process. Mr. Smee considered that the advantages of his galvanic process are the absence of nitrous fumes, greater uniformity of action than when acid is used, greater rapidity of biting, and at the same time any required depth of line can be obtained and the lines themselves will be sharper and cleaner, owing to the etching ground not being torn up by air bubbles. I am not aware that the suggestion of Mr. Smee has ever been commercially applied, but he has continued his investigations. In 1851 he presented a report to the governor of the Bank of England, in which he stated that he considered the time had arrived when surface printing from electrotype blocks could be advantageously employed in the production of Bank of England notes. His proposition has since been carried out, and at the present time Bank of England notes and cheques are so printed. I would not have it inferred from this fact that what is economic and available for Bank of England purposes, is either expeditious or commercially available. Those who desire full details of the process employed by Mr. Smee in the production of surface blocks, I would refer to a paper read by him before the Society of Arts, on the 20th December, 1854, and which is published in full in Vol. III., page 81, of the *Society of Arts Journal*. Etching by galvanism forms the connecting link between electro engraving and the daguerreotype art.

Etched Daguerreotypes.—The discoveries of Mons. Daguerre were first formally communicated to the world by M. Arago, who, on the 7th January, 1849, read an account of them before the Academy of Sciences in Paris. The invention consisted in the discovery of a process whereby the image obtained in the camera obscura could be permanently fixed on a metal plate. The process soon became known as the daguerreotype art, and its results as photogenic drawings. These were produced upon plates of copper coated with silver. The silvered surface was then washed with a solution of nitric acid, after which it was placed in a closed box, where it was subjected to the action of the fumes of iodine. An ioduret of silver was thus formed. Thus sensitised the plate was next exposed to the action of the rays of light within a camera, when the image to be copied became impressed upon it, and was then permanently fixed by immersing it in a bath of hyposulphate of soda. Having been well washed with clean water, it was capable of being exposed to ordinary daylight without injury. Mr. W. R. Grove, in 1841, described his method before the Electrical Society, and stated that he used dilute hydrochloric acid in the galvanic trough, having first coated the daguerreotype plate with gold, which amalgamated with the mercury on the surface of the plate, and that this acid, by acting unequally upon the different parts of the daguerreotype plate, according to the extent to which the light and the mercury had before acted, bit it away in the manner of an etching, so as to produce deep lines in the shadow parts and fainter ones in the light tints. The proposition of Mr. Grove was not lost sight of by Mr. Claudet, Mr. Fox Talbot, and others, who early made attempts to engrave and print from the daguerreotype plates, but the delicacy of the surface of the plate, and the nature of the subjects selected, prevented the process from being practically adopted. Subsequent discoveries, and the art of photography, to which I shall presently refer, have, nevertheless, produced some of the most perfect

examples of engraving by the combined action of light and electricity.

I must now retrace my steps and recall attention to the discovery of Mr. Murray, who, having succeeded in giving a conducting surface to non-metallic bodies by the use of plumbago, placed within the reach of the scientific man a new and as yet unheard of process of engraving, which is now known as Nature Printing. The first examples of this art were also due to the discovery and use of a substance made known to the world through the Society of Arts in 1843—I mean gutta percha.

Nature-printing, as it is called, was first introduced to the notice of the public through the Society of Arts, which, in its notes of proceedings for the year 1849, printed a communication from Dr. Ferguson Branson, of Sheffield, in which he stated he had ascertained that by embedding a fern leaf, or any other flat body in softened gutta percha, and then allowing the gutta percha to cool, upon removing the leaf a perfect mould was obtained, from which mould an engraved copper-plate fit for the printer could be secured by means of the electrotype process. A plate so obtained, with prints taken from it, accompanied the communication. Nature-Printing, however, did not long remain in this normal condition, for in the Exhibition of 1851, in the Austrian department, were exhibited specimens of plants, flowers, &c., printed in colours from copper plates. It had been ascertained that if a rolling pressure was employed to embed the object to be copied, that then soft sheet lead could be used, and that process was subsequently introduced into this country, and employed by Mr. Henry Bradbury in the production of his work on Ferns and Mosses. Nature-printing did not stop here, for in a communication read before the Society of Arts in 1854, by Mr. Aitken, of Birmingham, we find that, by means of a rolling pressure, objects of various kinds, and of the most delicate description, such as thread-lace, the down of a feather, &c., could be made to engrave itself in Britannia metal, copper, brass, German silver, or tin plate, and, to use Mr. Aitken's words, "more wonderful still, on what we are led to believe is the most dense and hardest metal in ordinary use, viz., steel." Mr. Aitken pointed out some novel and interesting applications of nature-printing then in use at Mr. R. F. Sturge's works at Birmingham, in the ornamentation of metal surfaces, by means of patterns cut out of sheets of paper, and placed between two plates of soft metal, and passed through the rolling press. The effect produced was that of a burnished figure in relief upon a frosted ground; this resulted from the contact of the two metal surfaces, which burnished each other; but the paper, being embedded in the two metals, gave to the surface of the metal round the pattern a grain which may be described as a print from the pulp of which the paper was made. I must not, however, here enter upon the industrial and manufacturing uses to which electrotype deposits and nature-prints have been applied, but will direct attention to another process, in which the principle of nature-printing has been proposed to be applied as a substitute for engraving—I mean the process submitted to the Society by Mr. George Wallis, and called by him Auto-typography. In this process Mr. Wallis substitutes for, or in combination with, a natural object, a drawing made upon a surface of gelatine. This he selects as it has no grain, and is to a great extent non-absorbent. His drawing is made with an ink or fluid, which, when dry, either crystallises or forms a naturally-granulated body in relief upon the surface of the gelatine. The drawing, having been carefully prepared, is then passed through a press, in contact with a metal plate, into the surface of which the drawing becomes embedded, and the result is a transcript in copper of the artist's own drawing, from which prints may be worked in the usual manner. Notwithstanding the suggestions above related, I regret to say we are still without that great desideratum, a surface block, or a ready means of obtaining one, at a commercially economic rate by a process which will give to the artist a true translation of his sketch or finished drawing, to the commercial world an economic means of extending a knowledge of art, and of cheapening the cost as well as extending and facilitating the means of book illustrations, and to the public the advantage of a ready means of cultivating economically a knowledge and a love for all that is elevating and beautiful, both in nature and art, as well as a means of educating the youth of our country by means of cheaper, more numerous, and better examples than are at present generally attainable. But before I close this communication, which I propose to do by referring to other processes which I thing deserve more attention than they have hitherto received, and which I believe to be capable of helping to solve the problem of how to obtain a surface block, I must, in justice, refer to the photo-galvanographic process of Mr. Paul Pretsch, the photo-lithographic process of Colonel James and others, and the process for enlarging and reducing drawings and engravings patented by Mr. H. G. Collins. I have already spoken of the efforts which Mr. Grove made to engrave the image obtained upon the daguerreotype-plate, and it is due to Mr. Archer, who was the first to propose the use of collodion as a medium upon which light might be made to impress an image, that I should state that it is to that gentleman's discovery that the world owes its present advanced position in the art of photography.

Photo-galvanography.—Without the collodion film Mr. Paul Pretsch's photo-galvanographic process of engraving would not have existed, as light could not be transmitted through the daguerreotype plates, and the paper processes of Mr. Fox Talbot and others would have been inadmissible. Mr. Pretsch knowing that gelatine, if treated with bi-chromate of potass and submitted to the action of light, possessed a power of expansion, and availing himself of that fact, used a photographic image taken on collodion as a means of partially intercepting the rays of light, thereby regulating their action upon sensitised gelatine, and as a result he obtained a positive photographic image in relief in gelatine. The image, being allowed to dry, was then coated with black lead, and served as a mould in relief upon which to deposit, and from which he obtained by electro-deposition an engraved copper-plate of the original collodion photograph, from which plate-prints could be taken as in ordinary copper-plate printing; and it is right to add that some of the best specimens of prints from chemically-engraved plates ever seen were so obtained and introduced into commerce. But the fault which attached to the aquatint and mezzotint processes of engraving, also attached to Mr. Pretsch's process, viz., the surface or grain of the plate was too fine to yield a large number of good impressions, and that is no doubt one of the many causes which have impeded its extended use. The acierage process of M. Joubert for coating copper plates with an iron surface (described below), was not introduced at the time Mr. Pretsch was working his invention. Mr. Pretsch succeeded in producing surface blocks by his photo-galvanographic process. In order to obtain a surface block, it must be borne in mind that the process, as compared with the intaglio plate, is reversed. In the engraved plate the impression is printed from the lines cut into the plate, but in the case of all surface blocks, it is the portions which are not to be printed from which have to be removed by the graver. In like manner Mr. Pretsch used a negative photograph in one case and a positive in the other, thus reversing his results.

Acierage.—The acierage process is thus described by M. Joubert:—

"My invention has for its object certain means of preparing printing surfaces, whether for intaglio or surface printing, so as to give them the property of yielding a considerably greater number of impressions than they are capable of doing in their ordinary or natural state. And the invention consists in covering the printing sur-

faces, whether intaglio or relief, and whether of copper or other soft metal, with a very thin and uniform coating of iron, by means of electro-metallurgical processes.

"It having become a desideratum to harden, if possible, the surface of a copper plate, and to protect it from wear while printing, in March, 1848, my friend, M. Jacquin, of Paris, took out a patent in this country for a method of coating plates with iron, which had already been successfully applied in France, and of which the merit is due to my friend, M. Henri Garnier, of Paris.

"I have myself had the advantage of co-operating with M. Garnier in the development of the invention, the principles of which I shall now proceed to describe:—

"If the two wires of a galvanic battery be plunged separately into a solution of iron, having ammonia for its basis, the wire of the positive pole is immediately acted upon, while that of the negative pole receives a deposit of the metal of the solution—this is the principle of the process which we have named "acierage."

"The operation takes place in this way:—By placing at the positive pole a plate or sheet of iron, and immersing it in a proper iron solution, the metal will be dissolved under the action of the battery, and will form hydrochlorate of iron, which, being combined with the hydrochlorate of ammonia of the solution, will become a bichloride of ammonia and iron; if a copper plate be placed at the opposite pole and likewise immersed, the solution being properly saturated, a deposit of iron, bright and perfectly smooth, is thrown upon the copper plate, from this principle:—

"Water being composed of hydrogen and oxygen;

"Sal-ammonaic being composed of

"1st. Hydrochloric acid containing chlorine and hydrogen;

"2nd. Ammonia, containing hydrogen, nitrogen, and oxygen;

"The water is decomposed under the galvanic action, and the oxygen fixes itself on the iron plate, forming an oxide of iron; the hydrochloric acid of the solution acting upon this oxide forms a hydrochlorate of iron, whilst the hydrogen precipitates itself upon the plate of the negative pole, and, unable to combine with it, comes up to the surface of the solution in bubbles.

"I would remark that it is important that a ferric solution should be employed which will not dissolve or corrode the plate intended to be coated, for if it be attempted to use such a solution, though the iron will be precipitated, it will not only be in a non-coherent state, but the engraved surface itself will be liable to be attacked and injured. It may also be remarked that the coating of iron admits of being removed from a printing surface of copper without injury to the original plate, hence the original plate may, after being coated and used for some time, have the worn coating removed, and then be re-covered with an iron coating as often as may be required."

Photo-Lithography.—Colonel James, of the Hydrographic Department of the Government, has introduced and used a process of photo-lithography, to which I cannot do more than allude. It is similar, in many respects, to the photo-lithographic and zincographic process described by Mr. John Walter Osborne, in the *Photographic Society's Journal*, vol. 7, pages 163 and 213, as follows:—

"In the first instance, a sheet of paper is prepared with albumen, in the usual way known to photographers; it is, when quite dry, passed through a copper-plate or lithographic press, upon a polished steel or copper-plate, by which operation it receives a very smooth and regular surface; it is then coated on the same side with a solution of gelatine, to which an addition of bichromate of potash has been made; this is then carefully dried in the dark, and again passed through the press to ensure the finest surface. This operation completes the preparation of what I shall call the sensitive paper. Having made a negative of the original map bearing the desired proportions to it, I place a suitable piece of the sensitive paper just described under and in close contact with the map, and the whole is exposed to daylight in such a way that the luminous influence passing through the transparent parts of the negative, shall strike directly upon the prepared surface, while the greater part of the paper is protected from its influence by the dark parts of the negative, which correspond to the white places on the original map. In the presence of the organic matter, the actinic agency effects the decomposition of the bichromate of potash, and the liberated nascent oxygen in all probability reacts upon the gelatine, altering its chemical characteristics in a peculiar manner. The visible effect, after removing the negative, is the formation of a picture in brown, upon the clear yellow of the paper, corresponding to the transparent portions of the negative, or to the black lines on the original drawings.

"This positive photographic print is next covered with an even coating of lithographic transfer ink, by passing it through the press, face downwards, upon an inked-in lithographic stone; the pressure causes the whole of the sensitive surface to lay hold of the ink, and bear away with it an even coating, hiding the brown photographic positive from view. The altered parts of the gelatine which have been exposed to the luminous action, appear to be possessed of a certain amount of affinity for the grease of the ink, so that they will be found to retain it with considerable tenacity.

"The next operation is to coagulate the albumen which still exists under the prepared surface; this is done by floating it upon boiling water, with the paper side downwards. A subsequent soaking for a short time causes the unaltered gelatine to swell in such a way as to raise the ink with it from the paper; and a slight amount of friction, with a sponge or other soft substance, removes the supperfluous ink from all parts of the inked print which correspond to the white parts upon the original document. When the lines appear clear and well defined, boiling water is poured over the whole, to remove the last traces of gelatine, and the print is dried. We are now possessed of a *bonâ fide* lithographic transfer, that is, a drawing, in greasy ink, of such a nature that it admits of being transferred to the stone in the ordinary manner, by simply inverting it thereon, and passing it through the press,—the albumen, which will be found to have withstood all the washing, acting as the adhesive substance under the ink to prevent the paper slipping on the stone.

"The whole of these operations need not occupy more than from two to three hours."

Process for Enlarging and Diminishing Engravings.—Mr. Collins' process for enlarging and diminishing drawings or engravings was chiefly mechanical and lithographic. The plan was as follows:—A print from any engraved plate, wood block, or lithograph, was taken in the ordinary manner, but in transfer ink, and upon a sheet of vulcanised india rubber, covered with a composition of equal elasticity, and of a non-porous character. If it were desired to enlarge the design, the india rubber upon which the impression had been taken was attached to a frame by means of hooks passing through holes made at equal distances round the edges of the india rubber. Four bars were then passed through the body of the hooks, and the sheet was thus prepared for the extending machine, which consisted of two parts, viz., a table and screws, the latter being used to stretch the rubber equally to the required dimensions. The impression was then transferred and printed by the ordinary litho or zincographic processes. If the design was to be reduced, the india rubber was stretched before the impression was taken upon it, and afterwards allowed to contract to the required dimensions in the regulating machine. Mr. Collins considered that his process would afford a ready means of adapting a design, when once made, to the size and character of the same work when printed in editions of various size of page. Mr. Collins, however, found the lithographic process of printing a great impediment in the way of his progress, and attempted to obtain a surface block by building up the impression transferred to

the stone, by depositing a succession of layers of printing ink mixed with suitable dryers, and when such building up of the ink had been carried sufficiently far, a cast in wax or other material was taken, and from the cast so obtained a copper block was secured by electro-deposition. This process was tedious and uncertain in its results, and like its predecessors, failed to secure the object aimed at.

I cannot help expressing an opinion that one great source of failure in the majority of the plans proposed has been, that the authors of them have been too ambitious in the selection of subjects. or almost entirely ignorant of the art of engraving. They have endeavoured to arrive at perfection at once, and have consequently failed. The subjects selected have in many cases been crowded in composition and too full of detail, and the result has been a deficiency of definition, a want of force, and an entire absence of artistic effect, due to the want of gradation in the lights and shadows. Several of the plans which have been proposed are probably capable of yielding good results, if the attempt to apply them is confined in the first instance to sketches in outline, a class of art but little practised, but one which is capable of affording the highest gratification and of employing the most skilled artists. By beginning with art in outline, experience in manipulation would be gradually acquired, and a chiaro-oscuro effect ultimately attained to if desired; and I have little doubt that blocks in outline can be readily produced, either by the electro-magnetic or mechanical process of Mr. Hansen, or the more recently-discovered processes of Messrs. Vial and Dulos.

Electro-Magnetic Engraving.—The process of Mr. George Hansen is as follows:—The drawing which it is desired to engrave is made on a metallic or conducting surface, with a resin ink, or some other non-conducting substance. As soon as the ink is dry or hardened, the plate with the drawing is placed on the moveable table or bed of a machine, side by side with a plate to be engraved. The machine is constructed somewhat on the principle of the planing-machine. A pointer or feeler is so connected by means of a horizontal bar with a graver, that when the bar is moved, the drawing to be copied passes under the feeler, and the plate to be engraved passes in a corresponding manner under the graver. The plate is engraved by placing the graver under the control of two electro-magnets, acting alternately—the one to draw the graver from the plate, the other to press it down upon it. The drawing being made on a conducting surface, an electric current is established, so that when the feeler or tracer which passes over the plate, with the drawing upon it rests on the metallic surface, it passes through the coils of the magnet, and causes it to lift the graver from the plate, but when it reaches the non-conducting ink of the drawing, the current of electricity is broken, and the magnet ceases to act, and, by a self-acting mechanical arrangement, the current is at the same time directed through the coils of the magnet, which then acts powerfully, and presses the graver down into the plate. This operation is repeated again and again, till the entire surface has been cut away to a uniform depth by the graver, by passing it in parallel lines over the entire surface of the drawing. From the plate so engraved a type metal cast is taken, which being a reverse, in all respects, of the engraved plate, is at once fitted for use as a block for surface printing.

M. Vial's Instantaneous Engraving.—The process submitted by Mons. Vial to the Society has been so recently described (Vol. xii., p. 179), that I need do little more than refer to it, and my reason for doing so at all is for the purpose of pointing attention to the fact that Mons. Vial proposed to engrave plates by biting in the design, which was on that portion of the steel plate which was uncoated with copper. The question which I have to ask is, could not Mons. Vial reverse his process, by making the drawing to be engraved with a material which shall deposit the necessary protecting surface of copper on the steel, allowing the blank surface of the steel plate to remain open to the decomposing action of the sulphate of copper and nitric acid, thus giving as a result the drawing in relief on steel. Casts could then be taken, from which electro blocks could be readily obtained, and if the minutely granulated surface of a daguerreotype plate was capable of being coated with gold, and bitten in by hydrochloric acid sufficiently deep to admit of being printed from, I can see no reason if M. Vial takes an outline subject, and applies a similar process, why he should not readily produce a good surface block.

M. Dulos' Capillary Processes.—The last processes to which I have to allude are those recently submitted by M. Dulos to La Société d'Encouragement, Paris, and a full report of which will be found in vol. xi., of the Bulletin of that Society. The report is accompanied by prints illustrative of the results obtained by the methods which he employs, and as these have not hitherto been published in this country, they will doubtless be read with interest. M. Dulos' process is based on the phenomena of capillary attraction; thus, if lines be traced with varnish on a silver or copper plate with a silver surface, and mercury be poured over it, duly levelled, the mercury will attach itself only to the parts not covered with varnish, and will stand up and form a slightly convex wall on each side of the lines traced on the plate. A similar effect takes place if the experiment be made with a ground glass surface using water or some other liquid instead of mercury. Take, then, a copper-plate with a silvered surface, and transfer to it or draw upon it, by means of lithographic ink, any design whatever; then cover the plate by means of the galvanic battery with a thin film of iron, which, of course, will only be deposited on the parts untouched by the ink. The ink is cleared off by means of turpentine, and the plate then presents a surface of iron with the lines of the design in silver. Mercury is then poured on the surface, and it attaches itself only to those portions of the plate which are silvered. The excess of mercury having been removed with a soft brush, the metal remains in relief. From this a mould may be taken, and, by means of the electrotype, a copper-plate may be deposited, and this will be an exact copy of the original plate, having the lines in relief. This will serve as a matrix from which intaglio plates may be multiplied to produce impressions in the ordinary way. If plates for surface printing are required, a copper-plate receives the design, as before, in lithographic ink, varnish, or other material, and the plate is then, by means of the galvanic battery, coated with a thin film of silver, the film only attaching itself to the parts not drawn upon. The ink is then removed by means of benzine or turpentine, and we thus obtain a plate in which the design appears in copper on a silver plate. The plate is then bitten in by acid, which attacks only the copper lines, the rest of the plate being protected by the surface of silver. The rest of the process proceeds as before. Such are the principles and outlines of M. Dulos' process, which he has now brought to practical working by adopting various modifications and details. Thus he replaces the mercury by an alloy fusible at a low temperature, such as that known as the fusible metal of Arcet, to which he adds a small quantity of mercury. This alloy, when poured over the plate in a melted state, acts precisely as the mercury does, but becomes hard when cold, thus at once forming a plate from which an electrotype copy may be made. This operation, however, must not take place exposed to the air; the plate should be placed under a layer of oil heated to 80° (176° Fahr.), the temperature at which the alloy melts. Oxidation of the surface is thus prevented, which would otherwise injuriously affect the process. Special means are, however, required for removing the excess of either the mercury or the fusible metal, without which the finest lines cannot be retained. An amalgam of copper is found advantageous in the place of either mercury or fusible metal. On the plate, with the design on it, and

treated as above, the amalgam is applied by means of a roller of silvered copper, which takes up all the amalgam lying free on the iron surface, and transfers it to the silvered portion. As soon as the amalgam sets an electrotype copy can be taken. M. Dulos suggests another modification, which depends on the property of silver to attach itself more easily to mercury than copper does, and the following is the mode proposed:—After having drawn the design on a copper plate with lithographic ink, the plate is silvered, and the ink washed away as before. If the plate be now plunged into a bath composed of a salt of mercury, say the sulphate, a chemical reaction takes place, by which the mercury becomes deposited on the silvered portion and the sulphuric acid attacks the coppered portion, or lines of the drawing. This operation, which lasts only a few minutes, forms lines in the copper, the sides of which are preserved by the transfer of the mercury from the copper to the silver. There is no more difficulty in drawing on the copper with the lithographic ink than on stone; and a drawing made in this way can be transformed into an intaglio, or surface plate, as may be required.

The following is a resumé of the processes used by M. Dulos.

Intaglio Plate.—The plate, drawn upon in the manner described, receives a coating of iron by means of the battery; the ink is then washed off, and it then receives, by means of the battery, a deposit of silver, which will only take place on the parts not covered with iron, *i.e.*, the parts drawn with the ink. A silvered copper roller, covered with amalgam of copper, is then applied to the surface of the plate. The amalgam attaches itself solely to those portions of the plate which are silvered, and leaves the iron uncovered. As soon as it solidifies an electrotype plate can be taken from it in copper which is ready for the press.

Surface-Printing.—The plate, and the design on it, as before, has a layer of silver deposited on it. The ink is then washed off, exposing the lines in copper, which then is oxydised by heating the plate. The silvered roller with the amalgam is then applied, and the amalgam attaches itself only to the silvered portion of the plate; and, on its becoming solidified, an electrotype copy is taken, which of course produces the lines of the drawing in relief, and a surface-printing block is thus produced, ready for the press.

Intaglio Plate.— This plate may be produced by using a salt of mercury instead of the amalgam. The plate with its design is silvered, and the ink is washed off as before; it is plunged into a bath of an ammoniacal sulphate of mercury, and whilst there the silvered roller is passed over its surface for four or five minutes. The mercury, by a chemical reaction, is precipitated on the silvered portion, and the plate is at once ready for printing from.

Surface-Printing. — A salt of mercury may also be used for this process; thus, the plate is drawn upon, coated with iron, washed and silvered as before, and is deprived of the iron by means of acidulated water. It is then plunged in the ammoniacal sulphate bath, and whilst there it is rolled for four or five minutes; the lines of the drawing are at once formed in relief. The plates thus formed may be at once placed in the printer's hands.

Aquatint.—The ordinary aquatint grain having been given to a copper-plate, a copper-plate in reverse is taken from it by the electrotype process. This plate is then silvered, and the drawing is made on it with the lithographic ink, the whites or high lights being produced by the scraper. A layer of iron is then deposited, and the ink washed away as before, and the roller with copper amalgam applied. From this an electrotype plate is made for printing, the hollows of which reproduce the original aquatint grain, the drawing, and high lights produced by the scraper. M. Dulos describes also another process, both for copper-plate and surface printing, in which he uses a white varnish (*vernis blanc*). The plate is covered with a varnish formed of caoutchouc and zinc white, which is readily cut through either with a quill pen or an ivory point, with which the design is traced on it. It is then plunged into the iron bath, and a thin film becomes deposited on the lines thus cut. If an intaglio plate be desired, the varnish is then washed off by means of a solvent, and the plate silvered, the silver only attaching to the copper surface, and not to the iron forming the design. The iron is then dissolved off the plate with diluted sulphuric acid, and the plate is treated with the mercurial salt as before. If a surface plate is desired, then the depositing the iron and silver is reversed. The copper amalgam may also be used if desired.

My object in writing this paper will have been attained if I have succeeded in showing the relation of the various art processes to each other. I have endeavoured to point out how each succeeding process has aimed at facilitating the means of reproducing and giving permanence to art, and a larger commercial product at a smaller cost to the producer and consequent advantage to the public. I have further endeavoured to show the methods which have been introduced, and the attempts which have been made to obtain more readily a true interpretation of the artist's conception, and nature's imprint of itself by means of a combination of lithography, photography, electricity, magnetism, and electrotypes, nature prints, and the amalgam of metals. Each process has been applied in the attempt to produce a surface-block from which to print. Hitherto, a commercial success has not been attained to, and my hope is that a knowledge of what has been done may cause others to carry on the investigation of this subject to a successful issue.

Fine Arts.

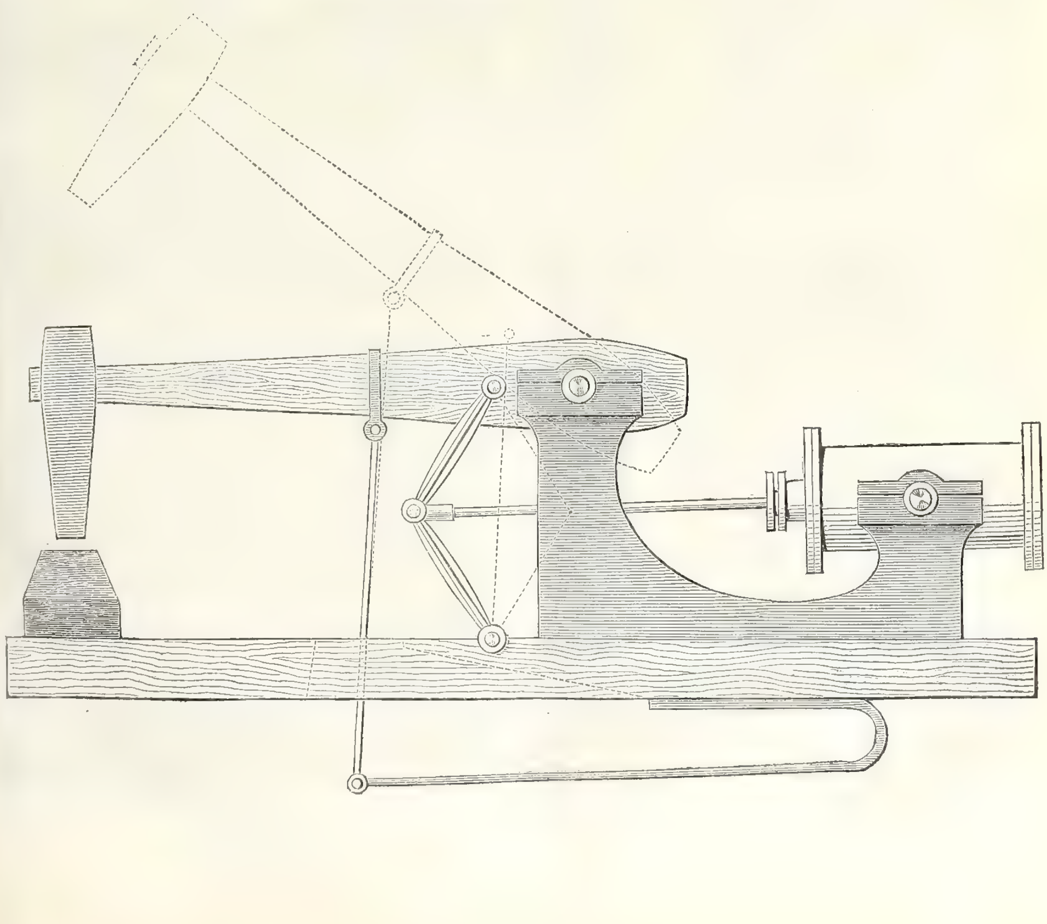
Public Monuments.—A grand memorial work is to be raised on the spot lately occupied by the Barrière de Clichy, to commemorate the brave defence made there under Marshal Moncey, in 1814, and the project has been submitted to public competition. Twenty-seven designs were sent in and six were chosen, the authors of which were invited to compete again amongst themselves. The prize has fallen to M. Doublemard. The principal group represents the Marshal protecting with his sword an allegorical figure of the City of Paris, and being supported by four other figures—a garde national, a man of the people, a polytechnic student, and a pensioner—these four classes having been conspicuous in the affair.—The subscription opened for the erection of a monument to the painter, Hippolyte Flandrin, in the church of St. Germain des Prés in Paris, has produced the sum of eleven thousand francs (£440), but as the work, designed by M. Baltard, is calculated not to cost so large a sum, it is proposed to apply the balance to the production of a repetition of the bust of Flandrin by Oudiné, to be placed in the Museum of Lyons, of which town the deceased artist was a native.—A colossal statue of Vercingétorix, the celebrated Gallic chieftain, is about to be raised in the town of Alise, the ancient Alesia, where that hero made a desperate resistance to Julius Cæsar. This statue is about twenty feet high, and the work of M. A. Millet, the author of a beautiful figure of Ariadne, of a fine bust of Madame Pauline Viardot, a memorial statue of the late Henri Murger, author of the "Vie de Boheme," and other well-known works. The model of the head, which was exhibited a short time since in the public gallery on the Boulevard des Italiens, promises well for the work. The difficulty and expense of executing such a gigantic work either in stone or bronze, have led to the adoption of an old and most artistic method, that of *repoussé* work, applied of late years almost exclusively to ornamentation, to architectural figures to be placed on churches and other high buildings, or to designs of a

peculiarly simple form, such as angels with long flowing drapery, for organ fronts and other similar applications. In the case in question the difficulties will be considerable, for the model is characteristically picturesque in its treatment; the lines of the statue are broken and complex, with the details in sharp relief, the draperies flying, the hair floating in the breeze, and the hands grasping the hilt of a huge sword with all the savage energy of a hero at bay. A considerable portion of the work is done, and report speaks highly of the effect as far as it can be judged at present. The *repoussé* work has been entrusted to M. Aubert, an artist who has practised that method with great success. It will be remembered, by those who take a special interest in such matters, that a *repoussé* figure of about the same size of the one in question, the work of a German artist, was exhibited for some time beneath the porch of the central entrance of the Great Exhibition building in 1862. The Vercingétorix, when finished, will weigh about five tons, including the iron skeleton which is to support the thin colossus. It is to be mounted on a granite pedestal, of a size proportionate to itself, and the whole will stand on a small hill, so that the profile of the figure will be seen against the sky in every direction.

The Righetti Hercules.—The fine bronze statue of the youthful Hercules, found during the excavations beneath the Righetti Palace in Rome, about the destination of which so much has been said, has really become the property of the Papal Government. It is said that the Emperor of Russia offered to become the purchaser for a sum equal to £14,800, but that the fortunate possessor, Count Righetti, made it a present to the Pope, and that the Pontiff, not to be outdone in generosity, immediately ordered the sum of 2,500 crowns to be entered in the records of the Holy See as annuity to the Count and his family. His Holiness is also said to have presented the Count's son with a rouleau of gold, and it is added, moreover, that the donor of the statue is to be raised to the dignity of a marquis. Such is the account at present current of the transaction.

Manufactures.

Direct-acting Steam Tilt-Hammer.—At the ordinary meeting of the Society, on the 23rd of November, a model of a tilt-hammer, the invention of Mr. Henry Reveley, was shown. The following detailed description will be interesting to the members:—It will be seen, by inspection of the accompanying cut, that the principle of action is that of the broken lever, or knee-joint, and that the hammer is lifted, or thrown to its extreme height, at every half-stroke of the cylinder by means of the piston-rod, which is connected with, and forms part of the knuckle-joint. It will also be readily seen that the arrangement resembles, as closely as possible, the muscular power of the arm and shoulder of the hammerman, when he brings down the sledge with accelerating velocity upon the point of impact. The diagram is on a scale of one-third of an inch, reduced from the working model on a scale of one inch to the foot. The dotted lines show the knee-joint in its three positions of front and back stroke, and at the point of greatest elevation, when the hammer is in a state of perfect repose, owing to the knee-joint being then perfectly straight. The driving power must be a vibrating high-pressure cylinder, with the usual jacket and slide valves, but no hand or starting gear will be required, only, as in all other steam hammers, the control of the steam way must be entirely in the hands



of the hammerman, or rather of his assistant, so as to be able to cause the hammer to strike a single gentle blow, or at the rate of three or four hundred per minute with extreme rapidity and power. The extent of the vibration of the cylinder is less than four degrees. In the diagram a spring is introduced, as in the original working model, in order to promote the return and fall of the hammer, but of course, on a large scale, the vacuum-piston would be the proper expedient.

Commerce.

WOOL. — Messrs. Ronald and Son, in their annual circular, state:—The imports of wool show a steady increase from year to year, those of 1864 being about thirty-one million pounds more than in the previous year, which increase consists chiefly of colonial wools. The exports, on the other hand, if compared with 1863, exhibit a falling off by about eight million pounds, owing to diminished shipments to America, caused by its almost prohibitory tariff; in fact, the decrease in exports to that quarter amounts to nine and a-half million pounds, but as opposed to this there is an increase in the exports to France, the total diminution is reduced to about eight million pounds. The quantity of wool left for home consumption is consequently very much more than in former years. From the Board of Trade returns we find that the exports of woollen manufactures have in the aggregate increased considerably, amounting for the eleven months ending 30th Nov., 1864, to £22,307,204, in place of £18,525,506 for the same period of the preceding year. Australian wools have this year arrived in larger quantity than ever, being 302,801 bales against 241,488 bales in 1863:—

IMPORTS AND EXPORTS OF COLONIAL, FOREIGN, AND BRITISH WOOL, FOR ELEVEN MONTHS:—

		Colonial. lbs.	Foreign. lbs.
Imports,	1860	86,460,239	42,202,888
,,	1861	96,095,597	33,464,621
,,	1862	99,278,974	48,560,126
,,	1863	107,226,923	47,270,926
,,	1864	128,730,453	57,184,135

		Colonial. lbs.	Foreign. lbs.	British. lbs.
Exports,	1860,	22,782,089	4,128,869	10,997,181
,,	1861,	38,087,570	6,580,625	14,501,006
,,	1862,	32,261,247	10,106,645	9,537,266
,,	1863,	43,163,742	12,179,788	7,956,463
,,	1864,	41,375,088	5,794,840	7,377,769

TEA SUPPLIES.—Messrs. Travers and Son, in their weekly Trade Circular, state that the Russian demand has been very much exaggerated, as during 1863 the shipments of tea to that empire only amounted to 1,280,788 lbs., but during the autumn of 1864, the readiest buyers of the new teas were the Russians, who were compelled to pay the high rates in order to get their purchases into the Baltic before winter began. With regard to the prospects of the tea trade during the present year, we may remark that the exports from China between June 1st and November 30th amount to 89,750,000 lbs., against 83,353,569 lbs., in the corresponding period last year; while the stock in the United Kingdom, in spite of a large and increasing home and export trade, continues as heavy as it was in the beginning of 1864. It seems probable, therefore, that the prices will decline still further. The reduction of the tea duty has already proved a great boon to the working classes, but it must not be supposed that they have yet reached one-fourth of their consuming power. While the middle and upper classes infuse 10 lbs. weight of tea per head throughout the year, the working man infuses less than three. When we consider that the slopes of the Himalayas alone are officially reported as capable of producing ten times as much tea as we at present import from all tea-growing countries put together and when we also bear in mind that Great Britain, Russia, and the United States are no longer the only tea-drinking countries out of Asia, but that all Continental Europe is gradually being weaned from the coffee-pot to the tea-pot, it may with confidence be asserted that the trade is in reality in its infancy,—that, large as our present consumption appears, it will be greatly increased in forthcoming years, while other nations who have as yet hardly begun to use tea will join in extending the demand, which can hardly exceed the supply.

Colonies.

THE CADIANGULLONG COPPER MINES.—Advices from the copper mines in New South Wales state that thirty tons of fine copper had been produced in October. The lodes continue of the same promising character, and the quantity of ore being raised is considerably on the increase. The fifth furnace has been completed, and a sixth is in course of erection. With these improved facilities, it is anticipated that there will be a large addition to the supply of copper monthly sent to market. It is also the intention of the directors to erect machinery for dressing the ore, which will further tend to increase the returns. The last parcel of copper sold by Messrs. Mort and Co., consisting of about ten tons, realised £92 5s. per ton.

SCHOOL OF ART FOR QUEENSLAND.—The sum available on public contribution of an equal amount is no less than £900. Upwards of £400 have been already subscribed; and, with the prospect of a substantial building, it can scarcely be doubted but that public confidence will be equal to a contribution of the remaining portion required to secure the whole of the parliamentary grant available.

COTTON AND ARROWROOT IN NEW SOUTH WALES.—Cotton and arrowroot have been grown by the Rev. Edward Holland, at Port Macquarie. Two bales of cotton, weighing altogether 319 lbs., were grown from Sea Island seed; it is considered by judges to be of very fair quality, being of a bright colour, rather strong in staple, and free from seed. Its value in Liverpool at the last quotations would be from 28d. to 30d. per lb. This is the largest quantity of cotton, the produce of the colony, that has yet arrived in the Sydney market. The arrowroot appears to be of very good quality, and to have been very carefully prepared. It was made by an experienced West Indian in Mr. Holland's employment. Mr. Holland states that he has about 400 lbs. of it, and that if a reasonable price were obtainable he could extend the production. It may possibly take some time to overcome the prejudice in favour of the imported article; but there seems no reason why the colonists should send to England for it if such good arrowroot can be made in the colony. At the recent show of the Agricultural Society a sample of sugar, also grown by Mr. Holland, at Port Macquarie, was exhibited, and attracted considerable notice; and the cultivation of sugar was strongly advocated by Mr. Holland, as one that would yield constant and healthy employment for thousands of old and young, while it would afford large profits to capitalists and cultivators who would take the matter up. Mr. Holland is entitled to much credit for the pains he has taken in testing the adaptability of this climate to the cultivation of the products of other countries, and also in communicating to the public the successful results of his experiments.

SILK IN THE CAPE COLONY.—The *Commercial Advertiser* states:—" A few days ago we paid a visit to the large collection of silkworms belonging to Mr. Wright, of the Royal Engineer Department, and were surprised to find that he had so large a number of worms, in all stages of their growth, some having but a few days previously emerged from their shell, while hundreds of others were forming cocoons of silk, and some had already finished

spinning, the produce of the cocoons having been wound off ready for making up into skeins. It is no exaggeration to say that Mr. Wright has hundreds of thousands of worms under his care. Some idea may be formed of their number and voracity from the fact that they consume daily two sacks of mulberry leaves. This number of worms are the produce of half-a-dozen female moths some two years ago, and we can but regard the success of this experiment of producing silk on a scale large enough for purposes of trade as highly satisfactory. The mulberry that grows wild in this country is ascertained to be the real China variety, and it is therefore the natural food of the silkworm. It is well known, and can be easily cultivated, and forms an excellent hedge. The first course is a mere trifle, the attention required can be given by a child, while the silk will always command £1 per pound in the market."

Notes.

SOUTHERN COUNTIES ASSOCIATION FOR THE ENCOURAGEMENT OF AGRICULTURE, ARTS, SCIENCE, MANUFACTURES, AND COMMERCE.—An Association under this head is now being formed, the objects of which are to promote by meetings in the counties of Hants, Berks, Oxford, Surrey, Sussex, and Kent* in succession,—1st, for the exhibition of stock and implements, or articles connected with the pursuits of any of the departments established by the Association; and 2ndly, for the reading of papers and discussions on subjects embraced within the scheme of the Association. The Association will be under the management of a council empowered to make bye-laws, offer prizes, nominate local or sub committees, fix meetings, and do anything necessary to the carrying out of the objects of the Association; and the Council is to consist of a president, two vice-presidents for each county, an honorary secretary for each department, and 36 members, of whom an equal portion shall be chosen from each county by the members belonging to that county, or in default thereof, by the members in general at the annual meeting. An annual meeting and exhibition will be held in the months of May or June. Portions of the mornings or evenings of each day shall be given to the reading of papers and discussion. Each separate branch of the exhibition will be arranged and managed, under the control of the Council, by a sub committee of the department to which it belongs. Other meetings may be fixed by the Council for the reading of papers and holding discussions. A department for each subject embraced by the Association is to be established, and the societies promoting these objects, for the purposes of the exhibition and meeting, will be amalgamated. Agriculture in all its branches, with its implements and machinery, will form the first department; natural history, local geology, botany, and horticulture, the second; the arts, manufactures, and commerce, as developed in these six counties, the third; local history and archæology, the fourth; and the improvement of the dwellings and the general condition of the labouring classes, the fifth. Any other department may be added by the Council. Every subscriber of 10s. per annum shall be a member, and entitled to vote for the election of the Council. Every subscriber of £1 shall, in addition, be entitled to receive the reports and papers of the Association. Every subscriber of £2 per annum shall, in addition, be eligible for the office of president and vice-president. No subject or question of a political tendency shall be introduced at any meeting of the Association. Communications may be addressed to the Hon. and Rev. Samuel Best, Abbott's Ann, Andover; or Thomas Pain, Esq., Ugford-cottage, Salisbury. The first general meeting of the members, for the election of the officers and Council, and other general business, will be held at Guildford, Tuesday, January 17th, at one o'clock. A large number of noblemen and gentlemen of influence, and residents in the several counties, have signified their adhesion to the Association.

* At a meeting held at Basingstoke, December, 12th, 1864, Viscount Eversley in the chair, the County of Wilts was removed from the scheme as being included in the Bath and West of England Society.

MICHIGAN LAKE TUNNEL AT CHICAGO.—The most important event connected with the Water Works, and making a part of their history for the year, is the commencement of work on the tunnel, to be extended out under the bed of Lake Michigan two miles, so that the water will be drawn from the lake that distance from the shore. This project was fully set forth in the last report of the Board, and was adopted early last year, as that promising to secure most certainly, and with least expense to the city, its supply of water from a point in the lake where it will not be affected by the discharge from the river, or other impurities from the lake shore. During the summer, examinations were made along the whole line of the contemplated work, by boring at short intervals, to the depth proposed for the tunnel, to ascertain the character of the material through which it would pass, and various observations were made to test the quality of the water at the proposed outer end and inlet for the tunnel, and to ascertain also the distance from the shore to which the water of the river reached after certain most marked discharges of the river into the lake. From the borings it was found that the material through which the tunnel would be built was uniformly clay, and apparently of a firm and even character; and the observations concerning the effect of the river on the lake showed that, even when most marked, no trace of its influenee could be detected much more than a mile and a quarter from the shore. The information obtained on these and various other points, satisfied the Board that the tunnel would accomplish the result sought for, and that the work was entirely practicable. The necessary drawings and specifications were prepared as speedily as practicable, and advertisements were issued in New York and Boston, as well as here, inviting proposals for the doing of the work. The bids were received and opened September 9th, 1863, most of the parties submitting proposals being present at the opening. The bid of Messrs. Dull and Gowen, of Harrisburg, Pa., being unconditional, and for the whole work, was accepted by the Board the day after the reception of the proposals, as the lowest and best bid. Soon after its acceptance, the Board made report of their doings to the Common Council, and requested to be authorised to proceed with the work, and to issue bonds to provide for its cost. The Council granted this desired authority by ordinance of October 5th, 1863. Subsequently to the execution of the contract, the Board desired to change the manner of constructing the land shaft, which was originally designed to be wholly of brick, and is so described in the specifications. The change consisted in substituting three cast iron cylinders, each ten feet long, essentially like the iron cylinders proposed for the outer lake shaft, in the place of the brickwork of the upper thirty feet of the shaft. This was done to facilitate the sinking of the shaft through the bed of quicksands overlying the clay, the distance through the quicksands to the clay being about twenty-four feet. The formal breaking of grouud took place on March 17th last, and the work has been in progress since that time, with occasional interruptions. As was anticipated, a good deal of difficulty has been experienced by the contractors in working through the water and quicksands, but the difficulty has been much less with the iron cylinders than it would have been with brick work, and the clay having been reached, it may reasonably be hoped that there will not be serious trouble from this cause hereafter. Of course the work is not sufficiently advanced to enable the Board to form a conclusion as to what rate of progress may be looked for. The time fixed in the contract for the completion of the work is November 1st, 1865. Besides the

change in the manner of constructing the land shaft, the Board have agreed with Messrs. Dull and Gowen to make certain changes in the outer crib, so that the crib will be stronger than as originally proposed, and so that solid masonry can be eventually substituted for the mass of loose stones with which the crib will be filled. The State Legislature had previously given the necessary authority for placing in Lake Michigan any piers to be found necessary for constructing and maintaining the tunnel, but, to avoid any question as to the right of the State to make such a grant, the sanction of the United States to the act of the State Legislature was obtained by act of Congress, passed January 16th, 1864. The tunnel is to commence at such point as may be selected by the Board of Public Works, on the lot now occupied by the pumping works of the city of Chicago, at the east end of Chicago-avenue, and on the shore of Lake Michigan; and to extend two miles out under the lake, in a straight line, at right angles to the general direction of the shore. The bottom of the inside surface of the east end of the tunnel will be sixty-six feet below the ordinary level of the lake, or sixty-four feet below what is usually known as "City Datum;" and the bottom surface will descend uniformly, at the rate of two feet per mile, to the west end of the tunnel. There are to be one land and two to four lake shafts; the land shaft at the west end, one lake shaft at the east end, and the remaining lake shaft or shafts at such intermediate points as shall be determined upon by the said Board, when the proper time for locating them shall arrive. The lake shafts are to consist of cast iron cylinders, and to be protected by hollow, pentagonal cribs. The tunnel is to be very nearly circular in form, and to have an interior width of five feet, and height of five feet and two inches.—*From Report of Chicago Board of Public Works.*

MEETINGS FOR THE ENSUING WEEK.

MON. ...Society of Arts, 8. Cantor Lectures. Mr. B. Waterhouse Hawkins, "On the Reproduction of Natural Forms by Art and Manufacture." Lecture III.
Asiatic, 3.
R. United Service Inst., 8½. 1. Captain Jasper H. Selwyn, R.N., "Mineral Oils as a Fuel for Steam Ships." 2. Mr. C. J. Richardson, "Petroleum as Steam Fuel."

TUES. ...Civil Engineers, 8. Continued Discussion upon Mr. Taylor's Paper "On the River Tees." And, time permitting, Mr. T. Hawthorn, "Description of the Port and Docks of Marseilles."
Statistical, 8.
Pathological, 8.
Anthropological, 8.
Royal Inst., 3. Prof. Tyndall, "On Electricity."

WED. ...Society of Arts, 8. Mr. Peter W. Barlow, F.R.S., "On the Best Mode of Applying Power to Propel Trains, on the Metropolitan and other Railways having Frequent Stations, and in Terminal Stations."
Meteorological, 7.
London Inst., 7.
R. Society of Literature, 4½.

THURS...Royal, 8½.
Antiquaries, 8.
Zoological, 4.
Royal Inst., 3. Prof. Tyndall, "On Electricity."
Linnæan, 8. 1. Mr. A. Hancock, "On the Anatomy of *Doridopsis*." 2. Dr. Kirk, "On a New Banana from Tropical Africa." 3. Mr. W. H. Brewer, "On the Forests of *Sequoia (Wellingtonia) gigantea*, in California."
Chemical, 8.
Numismatic, 7.
R. Society Club, 6.

FRI.......Philological, 8.
Royal Inst., 8. Prof. Tyndall, "On Combustion by Invisible Rays."

SAT.......Royal Inst., 3. Prof. Marshall, "On the Nervous System in Man and Animals."

Patents.

From Commissioners of Patents Journal, January 6th.

GRANTS OF PROVISIONAL PROTECTION.

Armour for protecting ships of war, &c.—3142—W. Tate.
Bedstead, portable—3124—A. H. Robinson.
Boiler tubes, stopping leaks in—3205—A. V. Newton.
Bonnet and cap fronts, &c., manufacture of—3168—C. G. Hill.
Books, &c., fastenings for—3158—G. Leach.
Bottles, apparatus for stopping—2966—J. H. Johnson.
Brushes—3209—J. H. Cheatle.
Carriages, lamps for—3138—W. Howes and W. Burley.
Chromates and bichromates—3203—B. Margulies and J. K. Leather.
Coal dust, method of aggregating—3170—F. Tolhausen.
Coating metals—3207—E. Morewood.
Coke ovens—3195—R. A. Brooman.
Cotton seeds, separating the kernel from the shell of—3118—R. A. Brooman.
Eggs, apparatus for boiling—2164—C. W. Standish.
Elastic fabrics, manufacture of—3136—H. L. Hall.
Engines—3112—S. Pettit.
Fencing and other staples—3187—T. P. Hawkins.
Fibrous materials, washing and drying—3122—W. McNaught.
Fire-arms, breech-loading—3144—E. Swinarski.
Flax, seeding and breaking—2082—G. Parsons.
Furnaces—3148—R. A. Brooman.
Gins, cotton—3199—W. H. Maitland.
Hasp locks—2954—A. V. Newton.
Inkstand, pen, and pencil holder, combined portable—3193—J. F. Wheeler.
Iron bridges—3166—J. Westwood, jun.
Jib sails, reefing and stowing—3150—J. Butchart, H. Stroud, and S. A. Morrison.
Land, application of steam to the cultivation of—3223—A. P. Blanchet.
Liquid meter—3134—R. A. Brooman.
Looms—3126—J. L. Norton and W. Ainsworth.
Looms—3176—J. Hargreaves.
Looms—3189—E. Taconet.
Looms, picker band used in—3162—W. Maynes.
Metal, cutting pipes and bars of—3213—J. Wolstenholme.
Metal plates, machinery for curving—3217—G. Alton.
Motive power, obtaining—2160—M. Barland.
Mules, self-acting—3130—B. Dobson, W. Slater, and R. Halliwell.
Night soil, collection and treatment of—2788—J. A. Manning.
Oils, obtaining purified or refined—3108—J. A. Pols.
Ordnance, apparatus for working and loading—3103—C. P. Coles.
Panoramic apparatus—3119—F. A. Chevallier.
Pottery, cylinders used in the manufacture of—3120—G. Brown.
Railway carriages, signalling or communicating apparatus for—3201—C. R. Bamber.
Railway trains, communicating and signalling on—3074—T. Wood.
Railway trains, communication by signals between different parts of—3172—J. W. Cowles and W. Warren.
Railway trains, signalling between passengers and guards—3156—S. E. Pettee.
Retorts, crucibles, &c., manufacture of—3185—J. Gillespie.
Sewage matters, treatment of—3160—H. Bird.
Sheets, surfaces, &c., flexible elastic waterproof—3110—C. Hancock and S. W. Silver.
Small metallic articles, apparatus for rolling, &c.—3219—J. Dodge.
Steam engines—3114—W. E. Gedge.
Steam engines, slide valves of—3152—H. J. H. King, H. E. Smith, and J. B. Howell.
Taps or cocks—3146—Sir J. Gray.
Varnish for protecting metals—3164—H. A. de Briou, jun.
Vessels, &c., affixing armour plates to—3197—E. Saunders.
Washing and scrubbing compound—3050—A. Surfien.

From Commissioners of Patents Journal, January 11th.

PATENTS SEALED.

1715. T. McGrah.	1767. J. Clark.
1718. A. V. Newton.	1768. J. G. Tongue.
1723. F. L. H. Danchell.	1770. J. Saunders.
1724. J. Robinson.	1771. D. B. Grove.
1725. Z. B. Smith & J. Richards.	1776. J. Gill.
1726. B. Greenwood & I. Underwood.	1778. J. Chalmers.
	1780. I. Swindells.
1731. St. J. V. Day.	1782. T. Johnson.
1732. J. Forbes.	1784. A. A. Bonnet.
1733. J. Tomlinson and T. Brassington.	1789. A. Barclay.
	1790. S. Whitehurst.
1737. G. O. Wray.	1791. W. Whitley.
1739. J. Francis.	1798. F. C. Cosserat.
1750. J. Gilmour.	1799. A. Espirat and E. Sause.
1758. J. Bernays.	1800. E. Lea.
1759. A. A. Croll.	1833. D. Hall and A. L. Roosen.
1764. F. W. Turner.	1857. H. A. Bonneville.
1765. W. C. Thurgar.	2167. W. Langham.
1766. R. A. Brooman.	2174. F. Weaver.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

55. J. Stenhouse.	140. W. S. Mappin.
56. H. Bessemer.	250. W. Clark.
59. C. W. Siemens.	46. J. Tatham.
60. J. Smith and S. Wellstood.	67. R. A. Brooman.
63. D. Wilson.	77. W. H. Preece.
65. D. Wilson.	138. W. L. Winans.
80. W. Clark.	240. W. E. Newton.
81. T. Ramsay.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

3178. T. Spencer.	16. J. Leeming.
3185. F. O. Ward.	

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, JANUARY 20, 1865. [No. 635. VOL. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Cantor Lectures.

"On the Reproduction of Natural Forms by Art and Manufacture." By B. Waterhouse Hawkins, Esq., F.G.S., F.L.S.

Mr. Hawkins will resume his Course, on Monday Evenings, as follows:—

Jan. 23rd.—Lecture IV.—On the fitness of designs, and their adaptation to the conditions of the materials in which they are to be produced. (Demonstrated by metal-work processes, sand-moulding, casting, and chasing).

Jan. 30th.—Lecture V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra-Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. A set of tickets for this purpose has been sent to every member.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

Jan. 25.—"On the Best Mode of Protecting London from the Ravages of Fire." By Chas. F. T. Young, Esq., C.E.

Feb. 1.—"On London Sewage, from the Agricultural Point of View." By J. Chalmers Morton, Esq.

Dwellings of the Labouring Classes.

In consequence of the unanimous recommendation of the Conference on this subject which was held in June last, the Council have appointed a Committee with the view of instituting an inquiry, to ascertain if anything can be done to remedy or to mitigate the evils arising from the want of proper Dwellings for the Labouring Classes.

The following is a list of the Committee:—

Acland, T. Dyke.
Akroyd, E.
Bass, Michael T., M.P.
Belper, Lord.
Berners, Lord.
Best, The Hon. and Rev. S.
Blaine, D. Roberton.
Bosanquet, C. B. P.
Buccleuch, Duke of.
Buckingham, Duke of.
Burnell, George R.
Chadwick, Edwin, C.B.
Chance, Robert L.
Chester, Harry.
Cole, Henry, C.B.
Cowper, Rt. Hon. W., M.P.
Denton, J. Bailey.
Dillon, John.
Ducie, Earl.
Ebury, Lord.
Farnall, H. B.
Fostescue, Earl.
Foster, P. Le Neve, Sec. Society of Arts.
Fawcett, Professor.
Godwin, G.
Graham, P.
Greenhill, Dr.
Hamilton, Edward.
Hare, Thomas.
Harrowby, Earl of.
Hastings, G. W.
Hawes, Wm.
Holland, E., M.P.
Holland, E. T.
Hoskyns, C. Wren.
Lankester, Dr.
Lansdowne, Marquis of.
Letheby, Dr.
Lichfield, Earl of.
Lumley, W. G.
Malahide, Lord Talbot de.
Marsh, M. H., M.P.
Maynard, H.
Mill, J. Stuart.
Morton, J. Chalmers.
Redgrave, Samuel.
Salisbury, Marquis of.
Shaftesbury, Earl of.
Shaw, Benjamin.
Shuttleworth, Sir J. Kay, Bart.
Smith, Dr. Edward, F.R.S.
Smith, Professor Goldwin.
Sopwith, Thomas, F.R.S.
Stanley, Lord, M.P.
Teulon, Seymour.
Twining, T.
Walker, G. H.
Waterlow, Alderman.
Wellington, Duke of.
Williams, C. J.
Wilson, George F., F.R.S.
Ware, Martin, Secretary to the Committee.

To accomplish this object in the most satisfactory manner, it has been determined to divide the General Committee into Sub-Committees, to each of which distinct portions of the inquiry shall be assigned, so that the inquiry into each part of the subject may proceed simultaneously.

A Sub-Committee will undertake the inquiry—

1. Into the causes which appear to retard the erection of proper house accommodation, and the improvement of existing Houses for the use of the Working Classes, in London and other large towns.

2. Into the operation of Imperial and Local Taxation on such Dwellings.
3. Into the Laws relating to the Transfer of Real Property in small plots, and the conveyance of chambers or *suites* of rooms.
4. Into the operation of the destruction of Houses for Railways, and for other local improvements.
5. Into the desirability of facilitating the means of conveying labourers to and from their work by railways.
6. Into the pecuniary results of investments in Buildings for the Working Classes, either by Public Societies or by Building Societies.

A Second Sub-Committee will inquire—

1. Into the causes which retard the erection of Cottages in the rural districts.
2. Into the effect of facilitating the conveyance of small plots of ground for cottages and gardens, as well upon landlords as on workmen.
3. Into the effect of relieving—in the interest of the public only—certain classes of dwellings from all, or a portion of, local and imperial taxation.
4. Into the effect of extending the areas of local taxation, either to the union or the county.

A Third Sub-Committee will inquire—

1. Into the operation of the Laws of Settlement and Removal.
2. Into the advantages or otherwise likely to arise from the establishment of a National Poor Rate.
3. Into the provisions contained in various existing Acts of Parliament for granting Loans for the improvement of Estates, and whether such provisions cannot be applied to improvements of estates arising from building Cottages thereon; and if so, what special conditions should be imposed on grants to be applied to such purposes.
4. Whether the provisions of the Common Lodging House Act, the Health of Towns Acts, and other Statutes relating to Public Health, may not be advantageously extended.
5. And whether there are any other means by which the Legislature can promote the object in view.

Members of the Society interested in this subject are invited to communicate with the Secretary of the Society.

ART-WORKMANSHIP.

The following letter has been addressed to about forty of the principal City Companies:—

GENTLEMEN,

The Society of Arts has for a long period endeavoured to improve the artistic taste and skilful manipulation of the Art-Workman.

It has sought to accomplish this by exhibitions of their works, and by giving prizes for the best works executed from examples provided by the Society, and, in the case of wood-carving, from the original design of the workman.

Last year and this year, the prizes given by the Society have been on a much larger and more comprehensive scale than before, amounting last year to between £500 and £600; and the adjudication of the prizes has been kindly undertaken by gentlemen of acknowledged taste and high professional reputation.

The Council of the Society, satisfied that great good has been done by these efforts, and urged forward by the members of the Society, and by members of various trades requiring the aid of well-trained and skilful workmen, venture most respectfully to ask for the co-operation of the City Companies in promoting this practical mode of stimulating the energies and encouraging the self-education of the Art-Workman.

To this end the Council of the Society submit to the consideration of your honourable Court whether a sum of money might not be appropriated as prizes, say of £15, £10, and £5, for works to be executed by art-workmen in the branch of manufacture or of art represented by your guild; for, although your guild may not now be directly connected with the production of works of art, the Council venture to suggest that every corporation is interested in the general question of good taste, and in seeing the products of it when it meets together. In any case they think that models or drawings of some of the valuable works of art belonging to your worshipful Company might be offered for imitation, especially in the precious metals. I may add that any prizes that your Company may be pleased to offer now will not be required till about this time next year.

The Council, in order to afford your honourable Court an opportunity of appreciating what the Society of Arts is now doing, previously to your arriving at a decision on this subject, will be gratified if you can attend a meeting, at the Society's Rooms, on Tuesday, the 17th January, at four o'clock, when the works executed by art-workmen this year, in competition for the prizes offered by the Society, will be exhibited, and every information relating to this subject—in which the Society feels great interest, and to encourage which they desire your co-operation—will be afforded. I am directed to say that if the Master of your Company wish it, I have instructions to call on him and afford him full explanations.—I have the honour to be, Gentlemen, your obedient servant,

P. LE NEVE FOSTER, Secretary.

P.S.—Any member of your Court will be admitted upon giving his card, with the name of the Company of which he is a member written thereon.

To the Master, Wardens, and Court of Assistants, of the Worshipful Company of ——

Proceedings of the Society.

CANTOR LECTURES.

THIRD LECTURE.—MONDAY, JAN. 16.

MR. HAWKINS commenced his lecture by drawing a parallel between the state of general education and the present state of art education. A few years ago the Society of Arts began their present system of examinations in general knowledge, in order to facilitate the education of the middle and industrial classes of society, but art education was still left in the same condition as that in which general education was placed a quarter of a century ago. Mr. Hawkins, therefore, suggested that the Society of Arts should do for art education what they had already done for the other branches of knowledge. The lecturer proceeded to speak of ornamental art as distinct from mere pictorial representation, and as connected with manufactures. He stated that the ornamentist required a more intimate knowledge of the structure of the forms of those animals which he intended to introduce into his designs, than the mere painter of pictures, who could always have a model before him and represent what he saw, whereas it was necessary that the ornamentist should possess the power of representing animal forms in any of the varied attitudes that he might desire without the presence of a living model. Mr. Hawkins pointed out the error that was made in supposing that the mere *reproduction* of natural forms is ornamentation, and said that the use that *ought* to be made of animals in ornament was to so adapt their attitudes that they shall fall into the lines of the design without violating nature. He referred to Mahomedan art (from which animal forms were excluded) as the perfection of the conventional treatment of the forms of vegetable life, and Indian and Chinese art as the perfection of ornamental combinations on which animal forms were introduced. The lecturer illustrated his

argument throughout with sketches on the black canvas, particularly of symbolic forms, the Nineveh bull, the Sphinx and Centaur, flying and aquatic dragons, &c.

SEVENTH ORDINARY MEETING.

Wednesday, January 18th, 1865; William HAWES, Esq., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society :—

Beloe, Chas. H., 26, Bedford-place, Russell-square, W.C.
Bishop, James, 176, Upper Thames-street, E.C.
Bowring, John, 51, St. Mary-axe, E.C.
Dean, John M., The Grove, Stratford, E.
Gibson, John, 1, Stamford-terrace, Stamford-hill, N.
How, Thomas, 29, Gloucester-place, Hyde-park, W.
Hughes, Joseph, 37, Queen-street, Ratcliff, E.
Lavey, Charles, 341, City-road, E.C.
Parker, George Bass, 25, Grove-terrace, Highgate, N., and 4, King-street, Cheapside, E.C.
Paty, General Sir George William, K.C.B., 24, Regent-street, S.W.
Peard, Thomas, 159, High Holborn, W.C.
Pendergast, John, 103, Adelaide-road, N.W.
Pike, Fred., 44, Charing-cross, S.W., and Dulwich, S.E.
Pitman, William, 210, Euston-road, N.W., and 88, Newgate-street, E.C.
Plowden, Trevor Chichell, Oriental Club, S.W.
Plucknett, George, 258, Gray's-inn-road, W.C.
Pratt, Hodgson, 8, Lancaster-terrace, Regent's-pk., N.W.
Rejlander, O. G., 129, Malden-road, N.W.
Robinson, Thomas, 260, Gray's-inn road, W.C.
Roebuck, William, 21, Ellington-st., Arundel-square, N.
Sconce, Gideon C., 48, Lincoln's-inn-fields, W.C.
Sexton, George, M.D., 63, Springfield-road, St. John's-wood, N.W.
Sharp, Henry Locker, 15, Great Cumberland-street, W.
Shaw, Maltman Wm., 24, Carlton-hill-villas, Camden-road, N.W.
Stanton, John, M.D., 9, Montagu-square, W.
States, William, 12, Prince's-street, Hanover-square, W.
Stevens, Henry, M.D., 78, Grosvenor-street, W.
Stewart, Donald, 7, Gloucester-terrace, Regent's-park, N.W.
Stuart, Charles, Manor-house, Stepney-causeway, E.
Taylor, John Henry, The Limes, Upper Holloway, N., and 15, South-street, Finsbury, E.C.
Teape, Hannaniah, 37, Trinity-square, Tower-hill, E.C.
Thomas, William, 20, Boltons, West Brompton, S.W.
Thorold, Rev. Anthony Wilson, 16, Bedford-square, W.C.
Vickers, Stanley, Hill House, Streatham-common, S.
Waller, Edmund, 217, Brompton-road, S.W.
West, William Nowell, 38, Montague-street, Russell-square, W.C.
Whytock, Alexander, 9, George-street, Edinburgh.

AND AS HONORARY CORRESPONDING MEMBER.

Honeyman, Rev. D., D.C.L., Antigonish, Nova Scotia.

The following candidates were balloted for and duly elected members of the Society :—

Bayley, John C., 1, Park-place-villas, Maida-hill, W.
Buxton, William, Lime-tree Lodge, Rotherhithe, S.E.
Hancock, Henry J. B., Duke's-hill, Bagshot.
Knight, John Peake, South Eastern Railway, London-Bridge, S.E.
Lowe, John Stanley, 31, Cornmarket-street, Oxford.
Melliss, George Whalley, 17, Talbot-terrace, Westbourne-park, W.
Parnell, Hugh, M.A., 3, New-square, Lincoln's-inn, W.C.
Strachan, Charles Henry, 51, King's-road, Camden-town, N.W.
Vincent, Henry, 28, Mornington-crescent, N.W.

The following Institutions have been received into Union since the last announcement :—

Darwen, Mechanics' Institution.
Redditch, Literary and Scientific Institute.

The Paper read was—

ON THE BEST MODE OF APPLYING POWER TO PROPEL TRAINS ON THE METROPOLITAN AND OTHER RAILWAY LINES HAVING FREQUENT STATIONS, AND IN TERMINAL STATIONS.

By PETER W. BARLOW, Esq., F.R.S.

My attention was first especially directed to the subject of the motive power on railways in the year 1844, when I was instructed by the directors of the South-Eastern Railway to report on the applicability of the atmospheric system to the Tunbridge Wells branch of the South-Eastern Railway, and my investigation, containing some experiments on the Tyler-hill incline of the Whitstable Railway, was laid before the Institution of Civil Engineers in 1845.

In the year 1848, on the opening of the North-Kent Railway, the locomotive superintendent reported to me that a much greater consumption of coke occurred than with similar trains on the main line, which was supposed to arise from the smaller radii of the curves and steeper gradients.

The stations being more frequent on this line, it was necessary, in order to understand the cause of this loss, to distinguish what portion of the total power was required to put the trains in motion as distinguished from that employed in traction, and I calculated the acceleration of trains with varying tractive power, which was compared with the observed acceleration of locomotive trains on the South-Eastern and Great-Western Railways, and with the experiments made by Mr. Stephenson on the Atmospheric Railway at Dalky.

It is sufficient for the present purpose to say that, with with due allowance for the loss of tractive force with increase of velocity, the experiments fully confirmed the theoretical calculations, and left no doubt of the practical accuracy of the formula. (See Appendix.)

In the progress of these experiments on locomotives, I remarked the serious loss of time which arose in getting the train into speed; and it will be seen by referring to the tables that on the South-Eastern Railway, at that time, one and a half to two miles was generally required to get the train into full speed, and, on the Great-Western, between three and four miles; and it became apparent, by testing the rate of acceleration due to the tractive power of the North-Kent engines, that it was impossible to make the journey (stopping at every station) in the time required, even if the trains had no friction or incline to contend with.

The only remedy was engines of greater tractive power and weight, and these have been adopted to such an extent, to meet all cases, that, under favourable circumstances, a momentum and velocity is given to the train in 150 yards that would be sufficient to take it half a mile on the level if the engine was detached; and having recently observed this fact, it occurred to me that in working metropolitan lines, with frequent stations, sufficient power might be given at the station by stationary power to propel the train, without the aid of a locomotive, to the next station; and having, upon careful consideration, arrived at an opinion that such a mode of working will give a greater average velocity, and be apparently superior in other respects to the use of locomotives in such cases, I have been desirous to lay my investigation of the subject before this Society, as a matter deserving of discussion, from its important effect on the capability of metropolitan railways to relieve street traffic.

In the ordinary duty of locomotives, as employed upon

the great systems of railways, the distance between the stations or points of stoppage is such that the great and important duty of the engine is to maintain the requisite speed after that speed has been acquired; and one of the first facts which an inquiry into the subject cannot fail to establish is, that the locomotive engine is admirably adapted for this purpose; and, as regards the fuel expended for a given amount of work, it is one of the most economical forms of engine in use.

This result will appear, whether we take the work performed by an express engine in a fast train, or a heavy goods engine drawing a slow train; and in either case it results that, provided the distance between the stations is large, so that the engine can work for a considerable time, exercising its power at a fair working speed, the economical working of locomotive engines, comparing the work done with the fuel consumed, become manifest.

When, however, the duty to be performed is that of working a line in which the stations are very close together, and the stoppages frequent, it then results that all, or nearly all, the work of the engine is expended in acquiring the travelling speed; and that, in fact, it has not ceased to accelerate its speed when it becomes necessary to shut off the steam and apply the brakes, so as to stop at the next station. In fact, the same engine which in long stages would make an average speed of 35 or 40 miles per hour, is incapable, with frequent stations, of making an average speed of 13 or 14 miles, even with a greatly reduced load.

In this condition of things, which is in fact the condition of metropolitan railways, a new set of circumstances has to be met, and the question arises whether, where these circumstances exist, stationary power, when applied in a manner strictly adapted to the case, is not more economical—capable of greater speed—and in all respects more suitable to the convenience and exigencies of the traffic than locomotive power?

In terminal stations the use of stationary power will add much to the simplicity of working. At present, as the locomotive arrives in front of the train, it is made prisoner until the train is removed. It has then to go to another part of the station to be turned on to take in coke and water, and then comes back again to the train it has to take out. These frequent operations not only wear out the road and points and crossings very rapidly, but cause constant stoppages to trains arriving to enter the station. To avoid a portion of this difficulty, the locomotives are sometimes run tender first, a mode of working which amounts to an admission of imperfection, and appears to foreshadow a change in the present system, particularly as the more the traffic increases the more these imperfections will be felt. When the stations are near together the time required to acquire the speed is so important an element that greater tractive power is requisite to enable a reasonable average speed to be maintained; and the power of the engine is governed by the power requisite to put the train into motion. Thus the actual power exerted to propel trains of forty tons every five minutes each way on a railway similar to the Metropolitan, of three and a half miles in length, at the velocity now adopted, would not, allowing one-third 214 horses, lost power, and 15lbs. per ton traction, exceed to obtain which at least ten locomotives, capable of exerting in the aggregate a power of 2,200 horses, are required in consequence of the combined losses from the extra weight to be conveyed, the power to overcome the inertia, and, thirdly, from the engine being restricted from making a fair working speed, these losses being in addition to that of the engine itself from friction, &c.

Seeing that it is necessary to use such powerful engines to passenger trains where the stoppages are frequent, it follows that the weight of the engine becomes large in proportion to the weight of the train, and therefore, if that weight can be dispensed with, much less power will suffice to give the same amount of speed, or, with the same amount of power applied, a much greater speed will be obtained. In like manner if the weight of the engine is dispensed with the train can be brought to rest in less time by means of the brake; and coupling this with the increased rapidity with which the speed at starting can be acquired, it follows that dispensing with the weight of the engine would be of very great advantage in the case of stopping trains. In order to show the disadvantages under which locomotives act when stations are frequent, a comparison is here made of the speed which will be obtained by a locomotive weighing 40 tons, having an effective tractive power of 4,000 lbs., with a stationary engine of the same power, and one of 8,000 lbs. tractive power, the stations being assumed to be 1,000 yards apart, and the railway in the first place level, the second on a gradient of 1 in 200, and the third on a gradient of 1 in 100.

The rate of acceleration is correctly represented by an incline obtained by dividing the total weight conveyed by the effective power, and will be understood by the diagrams on the next page, in which the line - - - - - - represents the incline due to the locomotive; the . . . . line that due to the stationary power with four thousand lbs. tractive force; and the line — - - — - — - that due to eight thousand lbs. tractive force. The following tables show the relative inclines and velocities:—

No. 1.—RAILWAY LEVEL.

POWER EMPLOYED.	Incline representing rate of acceleration.	Distance the power acts.	Time of passing 1,000 yards. Min.	Sec.	Average velocity per hour
		Yards.	Min.	Sec.	Miles.
Locomotive train tractive power 4,000 lbs.	1 in 56	794	1	57	17½
Stationary engine tractive power 4,000 lbs.	1 in 25	455	1	28	23
Stationary engine tractive power 4,000 lbs.	1 in 12	216	1	16	27

No. 2.—GRADIENT 1 IN 200.

POWER EMPLOYED.	Incline representing rate of acceleration.	Distance the power acts.	Time of passing 1,000 yards. Min.	Sec.	Average velocity per hour.
		Yards.	Min.	Sec.	Miles.
Locomotive train tractive power 4,000 lbs.	1 in 78	853	2	12	15½
Stationary engine tractive power 4,000 lbs.	1 in 28½	523	1	31	22½
Stationary engine tractive power 8,000 lbs.	1 in 13	228	1	18	26

No. 3.—GRADIENT 1 IN 100.

POWER EMPLOYED.	Incline representing rate of acceleration.	Distance the power acts.	Time of passing 1,000 yards. Min.	Sec.	Average velocity per hour.
		Yards.	Min.	Sec.	Miles.
Locomotive train tractive power 4,000 lbs.	1 in 125	905	2	37	13
Stationary engine tractive power 4,000 lbs.	1 in 33	405	1	34	21¾
Stationary engine tractive power 8,000 lbs.	1 in 13·4	242	1	20	25½

Fig. 4 is given to represent the relative velocities of the locomotive and stationary engines.

Fig. 1.—Railway Level.

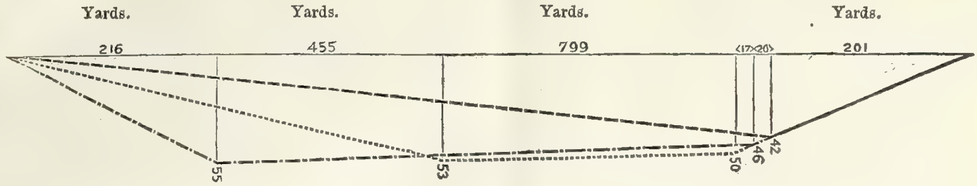


Fig. 2.—Gradient 1 in 200.

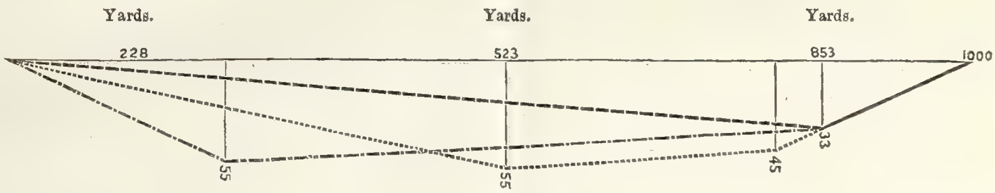


Fig. 3.—Gradient 1 in 100.

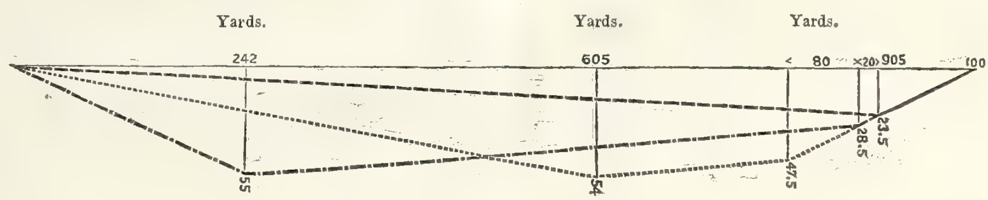


		Fig. 1.	Fig. 2.	Fig. 3.
		Miles per hour.	Miles per hour.	Miles per hour.
Locomotive power ------	Average velocity	17½	15½	13
Stationary equal power	,,	23	22½	21¾
Stationary double power — - — -	,,	27	26	25½

It will be seen, by reference to the table, that in the case No. 1, viz., level, the velocity has been increased from 17½ to 27 miles per hour, and the time saved 41 seconds. In No. 2 gradient, 1 in 200, the velocity has been increased from 15½ miles to 26 miles per hour, and the time saved 54 seconds; and in No. 3 gradient, 1 in 100, the velocity has been increased from 13 to 25½ miles per hour, and time saved 1 minute 17 seconds.

It will also be observed that the tractive force of the stationary engine, when double that of the locomotive, has been employed less than one-third of the distance, and therefore greater velocity has been obtained with less expenditure of power; and hence arises an important feature in favour of stationary power, as proposed to be applied, as not only less actual power is required, but, a short length only of propelling power being necessary, the loss of power and liability to derangement hitherto experienced in stationary power will, in a great degree, be avoided. The obtaining increased velocity with less power is apparently an anomaly, but its correctness will readily be seen, and will be illustrated by the experiment of applying a tractive power, by means of a weight sufficient to propel a carriage with a small acceleration. By applying four times that weight for a quarter the distance the acceleration is very rapid, and the average velocity will be increased with the same expenditure of power, and in degree depending upon the ratio of the accelerating power to the load in the two cases. I am, therefore, able to claim for stationary power, when stations are frequent, the advantage of superior speed, an advantage which has been found to be of importance to the success of railways generally, and their influence in the districts through which they pass, and one which there is no reason to doubt will equally influence the development of the traffic of metropolitan railways, if not to a greater degree, because the saving of time is at present less decidedly in favour of railways.

If stations were a little more frequent than they are, a good cab would still remain the quickest mode of travelling; and it is so now, unless the railway runs direct to the point to which a passenger is destined. Speed is also important, from enabling more frequent trains, and therefore a larger amount of traffic, to be carried on one line of railway.

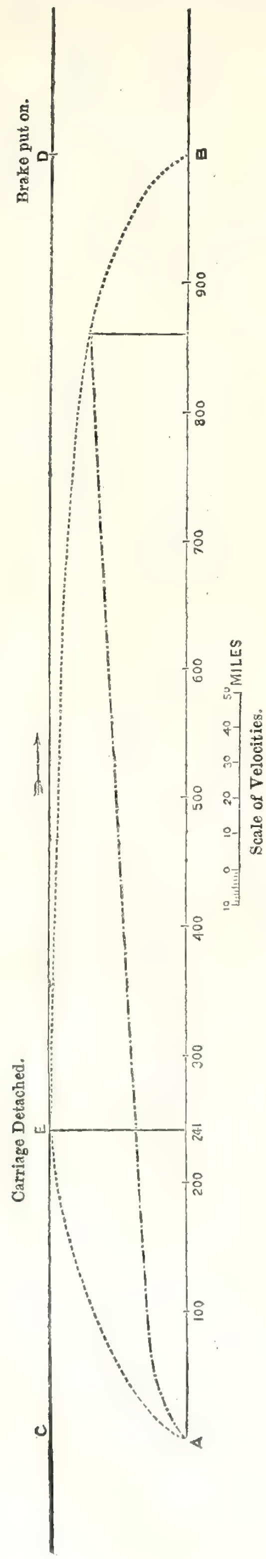


Fig. 4.—Diagram of Relative Velocities.

Velocity of Locomotive from A to B is represented by dotted line, thus: —·—·—·—
Velocity by Stationary Power from A to B is represented by dotted line, thus: - - - - - - - -
Velocity of an Ordinary Train—by a line thus ———
From E to B represents velocity of a carriage detached at E from the ordinary train.

The economy arising from stationary power is not here advanced as of the usual importance in railways, perfection of working being rather the point to be aimed at, as it would pay itself from the development of traffic in a metropolitan railway, even at greater outlay and cost, but as the economy claimed is so great as nine-tenths, with equal velocities, it is necessary to explain how this extraordinary difference arises. That the loss from the use of locomotives on metropolitan lines is fully nine-tenths of the power employed, is pretty evident, because the total duty performed in propelling trains of 40 tons every five minutes, equal to forty tons 84 miles per hour, or 200 tons $16\frac{4}{5}$ miles per hour, is not greater than one of the locomotives employed (which are in fact equal in tractive power to goods engines), would perform on a main line as a fair day's work, and the cause of this loss it is not difficult to comprehend. As before stated, it arises from three causes:—1st. The increased weight of the train from the addition of the weight of the engine. 2nd. The loss in overcoming the inertia of the train and consequent application of the brake; and 3rd. The large proportion of the time the locomotive is under steam, as compared with that on which it is employed advantageously in traction. The degree of economy from the weight of the locomotive being saved of course depends on the relation of its weight to that of the train. On railways worked by stationary engines, the weight and friction of the rope, from its great length, generally exceeds the loss from the locomotives; but in metropolitan railways the locomotives are required to be of such weight as nearly to equal that of the train, and, therefore, half is directly lost from this cause.

The loss from overcoming the inertia of the train will be arrived at by comparing the power employed in each case. If the double power represented by the line - - - on the diagram is continued for 100 yards, the velocity on the level will be 27 miles per hour; and if the train is allowed to run by its own momentum it will be $18\frac{1}{2}$ miles at the point where the brake is applied, producing an average of 20 miles, a velocity considerably exceeding the locomotive. The power exerted will be as 200 to 799, or as 1 to 4 nearly. This explains a loss of $\frac{3}{4}$ of the locomotive power, the remainder making it $\frac{9}{10}$, being due to the locomotive not being an accumulating power, or, in other words, the power exerted in the two cases is as 1 to 4, while the engine power necessarily employed is 1 to 10, from the engine being restrained from making a fair working speed.

The case here assumed for illustration is that of the railway being level. On gradients exceeding 1 in 200 it will be necessary to have a greater velocity than is now made by locomotives to give sufficient momentum, and thus a direct comparison cannot be made; in fact, the advantage claimed for stationary power, is the means of giving increased speed combined with great economy rather than that of excessive economy with the same speed. There is no doubt, however, that a saving could be made of two-thirds of the present cost, still giving a large improvement in speed.

Frequent trains are, in the opinion of experienced persons, both in this country and in America, necessary to develope the omnibus traffic; and there is no reason why, with stationary power, from the improved velocity, they could not be made to run every three or four minutes, allowing sufficient time for one train to leave its station before the following train was allowed to start. This could not be done without locomotives treble in number to the stationary engines, even if there was required to be one stationary engine at every station. Another source of economy will arise by stationary power, from less destruction of the permanent way, and, in underground railways, from a less dimension of tunnel being required when a single line is used.

The two important points of comparison, viz., speed and economy, are here shown to be in favour of stationary

engines, and as the avoidance of the locomotive would be a benefit to the travelling public, particularly in tunnels, and equally so to the residents on the line, by reducing the noise and vibration, and is also decidedly conducive to safety, stationary engines would appear to be the superior mode of working railways with frequent stations unless there arise practical objections to balance these advantages. Two objections have been suggested; one, that the rate of acceleration will be so rapid as to be unpleasant to passengers; and the second, that in the event of a train, from any cause, being stopped between stations, it would be left in a helpless condition for want of locomotive power

With reference to the first objection, it is only necessary to observe that the rate of getting into motion will not produce a greater velocity than $11\frac{1}{2}$ miles per hour at the end of 50 feet, which is not so great a rate of acceleration as arises in a carriage propelled by horses; in fact, if the rate of acceleration which now arises with locomotives in descending gradients was given to trains on the level and in ascending, a very important saving of time would be made, and no objection could arise on this point. With reference to a train being stopped between stations, it must be assumed that the momentum given to the train would be such that considerable brake power would be always required to stop it at the next station. The distance the train is to be propelled by momentum is much less than is done every day by detached carriages on the principal lines of railway; in fact, every locomotive train is propelled the latter part of its journey by momentum; and in the case of express trains more than a mile is required to stop, with the assistance of the brakes. The Greenwich and Blackwall Railways were worked into London by momentum nearly as far as is here proposed, and were never known to fail as long as the engine power acted properly. The cause of interruption to the traffic by an accident to the locomotive itself will be avoided, and that which now occasionally arises from the repair and renewal of the permanent way will be much reduced. On a metropolitan line devoted exclusively to passenger traffic, there are no level crossings, and the public are entirely excluded, so that the stoppage of the train, except from accidents, will be very rare, and no train would leave one station until the line was signalled clear to the next. A pilot locomotive, in case of accidents, would be used as at present, as the mode of applying the stationary power will not prevent the occasional use of locomotives.

On the Mode of applying the Stationary Power.

The mode of applying stationary power here suggested differs from that hitherto employed, inasmuch as it is not connected from station to station, or connected through several stations, like the Blackwall system, but each has a propelling power independent of the other, although the power may be derived at several stations from one engine. It also differs in that the power is used accumulatively, and thus a smaller power of engine is required.

I will now observe that the result of the experiments on the Whitstable Railway, previously referred to, and the examination generally of the subject of motive power, led me to recommend the Directors of the South Eastern Railway to substitute locomotive, and abandon the stationary engines on that line; and the alteration was attended with satisfactory results, not because there was any serious difficulty in the rope system, except its great weight and length, but because one locomotive was made to do the work of all the stationary engines, and a greater average speed was obtained. One of these ropes was 1 mile 70 chains in length; and on the Blackwall Railway the rope was above three miles in length to carry passenger traffic. Great mechanical skill and good workmanship is indicated by the fact that such a piece of machinery could be kept in order for any length of time, because the actual weight put in motion, and inertia to be overcome, in addition to the train, was much greater than that of a locomotive, besides the friction of 500 sheaves. These cases, however, prove that no practical difficulty or liability to derangement is likely to arise in the use of a rope for 150 or 200 yards only, as is now proposed; and it may be here remarked that although ropes have been superseded by locomotives in many cases, yet that still a large amount of traffic is carried on by ropes, and in one important instance, viz., Glasgow, the locomotives have been again abandoned for the rope on an incline of 1 in 43 for one mile fourteen chains used for passenger traffic.

The mode which first occurred to me of applying the stationary power for the present purpose, was, by Sir W. Armstrong's hydraulic principle, to give motion to a rope, which system has the advantage that one engine can be made to do the work of several stations by a water main laid along the line. Another form of propeller, very simple in its action, but requiring an engine at each station, is the descent of a weight raised by a small engine constantly at work.

The power expressed by a weight of forty tons raised thirty feet every two minutes and a half would propel a train of forty tons more than one mile and a quarter on the level before it came to rest; and a stationary engine of forty-eight-horse actual power, allowing one-third loss, would be sufficient to run forty-ton trains every five minutes each way, allowing for the loss from friction and the power required to bring the weight to a state of rest, which latter loss would amount to ten per cent. of the power. The cost of working such an engine, including repairs, would not amount to £2 10s. per day, so that the cost per train per mile would be under 2d. The trains may also be propelled on the atmospheric principle, either by the old plan, of a pipe, or Mr. Rammell's plan, of a small tunnel; and as the power is required only for a short distance, there will not arise the difficulty from friction and leakage which has hitherto been experienced in these modes of traction.

In another form of propeller suggested, which is specially adapted to frequent trains, the accumulation of power is made in the boiler. Driving wheels and cylinders, similar to a locomotive, are used to propel a rope for the required distance. The total weight of moving machinery will not in this case, including the rope, exceed four tons. A duplicate of every part, including the boilers, would be provided, and as there is an interval of eight hours' rest in each day, sufficient to replace any part which might be out of order, I submit that such a piece of machinery may be considered nearly safe from derangement. A propeller of either kind, it is suggested, could be used advantageously on railways worked by locomotives, for the purpose of starting trains from stations situated at the foot of inclines, where now locomotives, although generally master of their work, frequently fail in surmounting the incline, thus leading to loss of time and danger.

In conclusion I will observe that it is difficult for the author to describe a new suggestion without a bias in its favour, but I have endeavoured to lay the comparative merits of stationary and locomotive power fairly before the meeting. The subject is so important in its influenee on the value and extension of metropolitan railways, that I offer it for discussion without venturing to give a decided opinion of my own, until I hear the views of those eminent engineers who have devoted their attention to the subject of motive power, and which views, I hope, will be expressed on this occasion.

APPENDIX.

The formula used in calculating the acceleration is:—

$$v = 2\sqrt{\frac{P \pm \frac{T}{I} - \frac{T}{2240\,f}\,S.\ 16\frac{1}{3}}{T}}$$

I being the inclination of the railway.
P the tractive power.
T weight of train in lbs.
S length of the plane.
f friction of the train per ton.

The velocity given to a train of 40 tons by 4,000lbs. falling 600 feet or 8,000lbs. falling 300 feet, the friction being 15lbs., will be:—

$$2\sqrt{\frac{(8000 - 600) \quad 300 \times 16\frac{1}{3}}{89,600}}$$

$$2\sqrt{\frac{(8000 - 600) \quad 300 \times 16\frac{1}{3}}{89,600}} = 27 \text{ miles per hour.}$$

The power exerted will be for five-minute trains.

8,000lbs. falling 300 feet in two minutes and a half.

$$\text{or } \frac{8000 \times 300}{2\frac{1}{2}} = 940,000\text{lbs. in one minute.}$$

$$\frac{940,000}{33,000} = 28\tfrac{1}{2} \text{ loco. power} \times 5 = 142{\cdot}5.$$

add one-half...... 71·25.

213·75.

DISCUSSION.

Mr. Barlow said, before he described the experiments he had to bring before the meeting he wished to add a few remarks to what he had written. In suggesting a substitute for the locomotive he had no intention to undervalue the qualities of that engine; on the contrary, he regarded it as the master piece of mechanical engineering, and the results it produced were perfectly astonishing, as also was the amount of duty it was capable of performing; he entertained the highest respect for those men whose talent and thorough knowledge of the subject had brought that machine to its present state of perfection. He appeared before them, therefore, not as an opponent of the locomotive, but rather as a great admirer of it; and he merely suggested that this noble machine, when employed as the motive power on a railway of short length and frequent stations, was not able to exercise more than about one-tenth of its power. What he (Mr. Barlow) submitted was, that under certain circumstances stationary power might be employed with advantage; and because it had failed under other circumstances there was no proof that it would not succeed under those which had now arisen. The alteration he suggested in the application of stationary power, consisted in this—that instead of applying that power between station and station, he applied it for such a distance that the momentum, or *vis viva* of the train, was brought into play, and this was as much a force as the force of steam, and could be depended upon as well as any other force. He proposed to apply the power of the rope for such a portion of the distance that the momentum of the train would carry it with perfect certainty to the next station. The advantage of applying it for a portion of the distance and allowing it to act in that way, arose from a particular law of accelerating forces, from which it resulted that a greater tractive force applied for a portion of the distance would accumulate a momentum that would give greater speed than a smaller tractive force applied for the whole distance, the actual *power* being the same in each case, because the greater force acts for a proportionately less distance. Mr. Barlow then proceeded to illustrate this principle by a model of a carriage propelled by means of a weight suspended. By applying four times the tractive force for a quarter of the distance only, he obtained greater velocity over the whole distance than by applying the tractive force for the whole distance. The difficulty with regard to stationary power hitherto had been the great length and weight of the ropes; but with short ropes he submitted they could manage the machinery perfectly well. Another experiment was shown, to prove that by reducing the weight of the carriage by about one quarter, double the velocity was obtained with the same amount of motive power. This was brought forward to show that where the duty of the locomotive engine was an accelerating and not a tractive power, by relieving the train of the weight of the engine, they did more than save the mere weight of the engine, and therefore produced a greater economy on lines where there were frequent stations than on lines where the duty of the engine was entirely of a tractive character. The principle of accelerating force was further illustrated by the motion of a ball rolled down first a gentle incline, and then down a steep incline, and so carried by its momentum up a gradient to the same level as before, but with a greater velocity. This explained why a greater velocity was obtained when the same power was employed over a shorter distance.

Mr. Imray said that as, in the course of several conversations with Mr. Barlow, that gentleman had asked him to look into his calculations, he would now venture to state his opinion as to their accuracy, and to explain as briefly as possible the view he took of the principle on which Mr. Barlow had based them. It might, at first sight, be difficult to understand how by a temporary impulse given to a train, instead of a continuous traction being applied to it, there could be an economy of power for a given speed, or an increase of speed for a given power. The illustration which Mr. Barlow had given of a ball rolling down one incline and thereby acquiring momentum sufficient to carry it up another incline, appeared to him to embody the whole principle under discussion, and he would endeavour to apply, as clearly and briefly as he could, the same principle to the case of a railway train running on a level. From the experiments made by Pambour, it appeared that the resistance to the motion of a train amounted on the average to 10 lbs. per ton or $\frac{1}{224}$th of the weight in motion. The experiments conducted by the British Association seemed to show that this resistance amounted to about 8 lbs. per ton, or $\frac{1}{280}$th of the weight. Since those experiments were made, great improvements had been effected, both in the carriages and in the permanent way; but, without laying any stress on that circumstance, he would merely take the mean of the above figures, and state the resistance as about 9 lbs. per ton, or about $\frac{1}{250}$th. It might, in fact, be taken that a train in motion was subject to a constant retarding force equivalent to that which it would, without friction, encounter in running up an incline of 1 in 250. If then a train were started with the velocity which it would acquire in descending such an incline, it would, leaving friction out of account, ascend that incline before its velocity entirely vanished. Assuming that the stations were one mile apart, and that it would be desirable for the train to retain a certain amount of speed, say seven or eight miles per hour, to be overcome by the brakes on reaching the farther station, the length of the incline might be taken at 6,000 feet. The gradient being 1 in 250, the total height of the incline measured from base to summit would thus be 24 feet. In other words, a train descending through 24 feet of vertical height would attain sufficient velocity to carry it one mile on the level, retaining at the end of the mile a velocity to be arrested by the application of the brakes. The power necessary to effect this upon a train weighing 40 tons or 89,600 lbs., would be 89,600 × 24 = 2,150,400 foot lbs., or equivalent to the work of a 65-horse engine during one minute. As to the mode of giving this velocity, he would not trouble the meeting with any remarks, for that was rather a question of practical engineering than one of figures, to which he now wished to confine himself. Let it, however, be assumed, for illustration, that the velocity was given to the train by causing it to descend an incline of 100 yards, or 300 feet, in length. The total descent being 24 feet vertical, this would give an incline of 1 in 12½, or a tractive force of 721 lbs. for a 40-ton train; and whether the velocity were given by the descent of such an incline, by the application of rope traction, or by any other means, the power expended and the result produced would be precisely the

same. As to the objection which would, no doubt, be raised to Mr. Barlow's system, because the velocity would be too rapid, or rather too suddenly imparted, he was of opinion that it was quite groundless. The rate at which a passenger was put in motion in a cab or omnibus considerably exceeded that contemplated in the case in question. Any one that had taken a trip on the "Montagne Russe," where the descent was something like 1 in 4, must have experienced a start something like three times as sudden as it would be in the case under consideration, and he (Mr. Imray) would observe, for his own part, that the sensation on the "Montagne Russe" at starting was rather pleasant than otherwise. To quote another instance, that of the Cycloidal Railway, where the passenger was inverted in his progress towards the terminus, the descent at starting was something like 1 in 2, and certainly no unpleasant shock was occasioned at the start in this apparently perilous journey. He regretted having occupied the time of the meeting so long with dry figures, but he trusted that he had succeeded in confirming the truth of Mr. Barlow's calculations, and he had only to thank his hearers for the patient attention with which they had listened to his observations.

Mr. Zerah Colburn remarked that he had no doubt the system now brought forward possessed advantages in respect of the working of underground railways, especially in avoiding the nuisance arising from the vapours of combustion from the locomotive engine, and it would save much of the great wear and tear of permanent way caused by the locomotive itself; but, it seemed to him, when they had got so far all the advantages of the proposed system were at an end. He did not know whether Mr. Barlow had proposed to adapt the railway to the system or the system to existing railways. If it was proposed to adapt this system to the Metropolitan Railway, he would apply it to the case of the King's-cross and Gower-street section on that line. The distance between those two stations was 50 chains, or five-eighths of a mile, with a gradient of 1 in 100, or a total rise of 33 feet. A train to arrive at Gower-street from King's-cross must, upon the proposed system, start with a velocity at least equal to that which a body would acquire in falling from a height of 33 feet. This would be expended in overcoming gravity only, but they had also to overcome the friction and the resistance of the atmosphere. Instead of the sum of these resistances being only 15 lbs. to the ton he believed the experiments made on the Metropolitan Railway showed that the resistance at the moderate speed employed on that line was something like 25 lbs. per ton. He would take $22\frac{4}{10}$ lbs. per ton as a convenient figure. Thus, in order to get over the gravity and other resistances over that distance, the train must start at a velocity equal to that of a body falling from twice 33 feet, or 66 feet. But it would not do to run into Gower-street station by the simple exhaustion of the momentum of the train. It should have a terminal velocity of at least 15 miles an hour to be extinguished by the brakes. In order to do that, the falling body assumed would have to fall from an additional height of $7\frac{1}{2}$ feet; therefore the train must be started with a velocity equal to that of a body falling $73\frac{1}{2}$ feet in order to arrive at the intended point on that gradient. The velocity required would be something like 70 feet per second, 66 feet per second being equal to 45 miles an hour, and that would hardly be a proper rate at which to start in order to get over the short distance between those two stations. The question was whether it would be safe or prudent to start at that speed. Would the carriages bear the great strain necessary to produce it? Would they keep the rails? Then, again, the whole of the power applied to the train was to be expended within a distance of 300 feet. A train of 40 tons weight was assumed, but this he believed was but about half the maximum weight of the trains on the Metropolitan railway, irrespective of the engine. To give a train of even 40 tons a velocity of 66 feet per second, starting up this incline, would require the exertion of about 6,300,000 foot lbs. of mechanical power, which had to be put into the train in a distance of only 300 feet, so that the constant force must be equal to 21,000 lbs., or nearly three times the maximum power of the engines now employed on the Metropolitan railway.

Mr. Barlow said the speaker was arguing upon entirely wrong premises.

Mr. Colburn inquired within what distance the power was to be applied?

Mr. Barlow replied 242 yards.

Mr. Colburn added, that brought the rate down in the proportion of 726 to 300; but his argument was merely to illustrate the case of 300 feet, which had been mentioned. It would be a most rapid acceleration of speed even if the distance were twice and a-half what he had first supposed to be intended. The power was applied very suddenly, and the starting must be at the rate of 45 miles an hour to do the distance between those two stations, and he did not think either the carriages or the line could stand that, even if it were not productive of great inconvenience to the passengers themselves. Besides, he had heard no mode suggested by which that velocity could be obtained within so short a distance, nor did he yet see how the power was to be connected with the train without causing violent shocks. On these points he should be happy to hear Mr. Barlow's explanations.

Mr. Seymour Teulon would feel obliged if Mr. Barlow would explain the manner in which he proposed to connect the rope with the train for so short a distance, and also how he proposed to disconnect it.

Mr. Barlow replied that the length of the rope depended upon the gradient to be worked. If the gradient were 1 in 100 it would require a greater length of rope, and the steeper the gradient the more advantageous was this system. The mode of detachment from the rope was precisely that adopted on railways at the present time, viz., by means of a pin.

Mr. T. Marr Johnson thought Mr. Barlow had lost sight of the extreme inconvenience of fixed plant. It was the great difficulty which attached to the atmospheric and the pneumatic systems. Let them imagine the inconvenience of a break-down of the engine. Mr. Barlow said there were eight hours of the twenty-four left for repairs: but on the Metropolitan Railway there were only four hours. In case of a break-down Mr. Barlow had said there would be a pilot engine to get over the temporary difficulty, but this could not work the traffic. If there occurred a break-down of the engine or rope, the chances were it would take a week to repair; and even with plant in duplicate it might take a day. If the traffic of the Metropolitan line were stopped for a day, 30,000 people would be prevented from travelling over it, which would ultimately have considerable effect upon the dividends of the shareholders. It was absolutely necessary, not only that the trains should run with great frequency, but that they should also run with the greatest certainty, or travellers would be deterred from using the line. Another consideration with respect to the adoption of this system to the Metropolitan line was the fact that that line was worked in connection with the Great Western and the Great Northern railways. The trains of those lines could not possibly be worked partly by locomotive and partly by rope traction. Locomotives must work the long traffic, and might therefore as well bring the train on to Farringdon-street. The truth was, moreover, that in order to get over the difficulty of a break-down of the machinery, it would be necessary to keep eight or ten locomotives in stock.

Mr. Burnett said that the tractive force required to propel the trains on the Metropolitan Railway up the incline of 1 in 100 between King's cross and Gower-street was 6,900 lbs. for a train of 70 tons. Deducting the weight of the locomotive, which might be assumed as

one-third that of the whole train, the force required would then be two-thirds of the 6,900 lbs.

Mr. Thos. Webster, F.R.S., said the subject before them was one of much interest, and they must all feel indebted to Mr. Barlow for having brought forward a proposal having for its object to obviate what was, no doubt, a great difficulty in the working of a railway like the Metropolitan. All engineers, he believed, had come to the opinion that it was desirable, if possible, that some other system of working these lines should be adopted. The locomotive engine was no doubt one of the most perfect machines ever invented, and the amount of work it was capable of doing was astonishing; but when they considered it was adapted, in the first instance, to the working of long lines, carrying enormous weights, with few stoppages as compared with the metropolitan system, which involved a great number of stoppages, the time he thought had arrived when they should endeavour to provide some other means of propulsion on the metropolitan system, which was being so rapidly extended, particularly as in long tunnels the foul air from the locomotive was a serious nuisance. At the same time it could not be denied that, as was stated by Mr. Johnson, the difficulties in introducing either the rope, the atmospheric, or the pneumatic system on such a line as the Metropolitan were very great; but he thought it was no answer to the proposition before them, to say there were difficulties in the way of its adoption. They must look at the whole question, because he thought there was a strong feeling on the part of the public, and of many engineers, that the whole system of working these metropolitan lines must be reconsidered. If that were so, although they must admire the great skill with which the Metropolitan railway was worked, he thought a proposition coming from a man of Mr. Barlow's practical experience ought to be received with the greatest consideration. The atmospheric principle, judging from former experiences of it, he apprehended was quite out of the question, and the pneumatic system was as yet almost untried. The question was a most important one, and Mr. Barlow having brought it before them—not as an amateur—not as a mere adventurer, but as one who had had a vast amount of experience in the working of railways, he hoped it would receive, as it deserved to do, most careful attention.

Mr. Chas. Vignoles, F.R.S., believed that theoretically and mathemetically Mr. Barlow's calculations were accurate. He would say with regard to what had fallen from Mr. Johnson, that the difficulties attending the break down of the stationary machinery were not much to be apprehended. Both the atmospheric and rope systems had worked for many years without any failures from the breaking down of the engine. He thought as far as the ordinary practical working of a line was concerned, the stability of fixed engines as they were now made might be entirely depended upon, particularly if duplicates were supplied where necessary; but with these admissions he was not prepared to say that the system of working metropolitan lines by stationary rather than by locomotive power, had arrived at that degree of ripeness that they could adopt it. The atmospheric system was worked for many years with some failures, but the truth was it did not pay from a variety of causes. He was not aware of the precise reason why the rope on the Blackwall line was abandoned; but he could quite understand that on a line perfectly open a comparison between the locomotive system and stationary engines would be very much in favour of the former. But, now they had railways under ground, there were a variety of circumstances, chemical, sanitary, and otherwise, which altered the nature of the case very materially. He quite agreed with Mr. Webster that the time had come when they should seriously discuss the desirability of working these metropolitan lines by other means than the locomotives now in use. He was not prepared to say Mr. Barlow's system was the best. He thought that gentleman had underrated the power of resistance, though perhaps Mr. Colburn had overrated it, and therefore he thought the motive power calculated on by Mr. Barlow was too low; but in his opinion sufficient had been said to show that the stationary system was worthy of trial. He apprehended it would be difficult to get that trial, owing to the great expense it would involve, and he did not think an experiment on a small scale would be successful. With all Mr. Barlow's mathematical talent he thought the system was hardly ripe enough to be brought into practical operation, though he felt indebted to him for having brought the subject forward.

Dr. Bachhoffner remarked that the sanitary question, in connection with underground railways, owing to the nuisance in tunnels arising from the vapours of combustion from the locomotive, was a very important one. He expressed his surprise that during the discussion no allusion had been made to the description of locomotive which he understood had been modified by Mr. Fowler to such an extent, that it gave out no vapour whatever during the passage through a tunnel. In fact, it was a gigantic tea-urn, with a heater inside of sufficient capacity to keep up the steam, while passing through a tunnel, without any products of combustion escaping from the furnace. He was not aware whether that kind of engine was generally employed on the Metropolitan Railway. As far as he gathered of the mode of attachment of the train, it appeared to him that both in the attachment to, and detachment from, the rope, a very sudden jerk to the passengers must be occasioned.

Mr. S. Teulon said when he asked the question as to the mode of attaching the carriages to the rope, he did so as one materially affecting every system of rope traction where the rope was not continued from one terminus of the line to the other. He believed the rope on the Blackwall line was abandoned in consequence of its connection with other lines, worked by locomotives, rendering that system inconvenient. He fully agreed with the opinions expressed by Mr. Webster and other speakers that, where a railway consisted mainly of tunnels some other mode of traction than the locomotive should, if possible, be adopted; but he doubted whether in practice it would be desirable to have a series of either weights or stationary engines, because there would be a difficulty of detachment as the carriages arrived at each station. It was stated in the paper that with frequent stations on a metropolitan line, worked by locomotives, a journey could be accomplished quicker in a cab with a good horse than by the railway, and he should be glad to hear whether, under the system proposed, the journey by railway would be expedited. He apprehended that unless the train was started at greater speed by this system than by the locomotive they would be in the same position in that respect as they were now. With regard to the jerk at starting, they all knew that if the driver turned on the steam too quickly at first an effect not pleasant to the passengers was produced. Although a system of rope traction might be a very good one where the stations were close together, and where all the carriages were attached to the same power, so that they could not have one carriage overtaking another, they must remember that on all the metropolitan lines they had to provide for the arrival of locomotives from long distances on other lines; because he did not understand that the rope system was proposed to be adopted throughout the country. He had much desired to call the attention of Mr. Barlow to difficulties which at present he had not shown how he could overcome.

Mr. R. K. Bowley begged to remind the meeting that Rammell's Pneumatic Tube had been at work regularly for a long time at the Crystal Palace without interruption or accident. He would not give any opinion on its merits, but would merely state this fact for the information of the meeting.

Mr. Chubb, having been connected with the management of a metropolitan line for the last ten years, would

say it struck him that the suggestions of Mr. Barlow amounted to a return to a system which he regarded as altogether exploded. The rope traction on the Blackwall Railway was an utter failure. Mr. Robert Stephenson stuck to his child till he could endure the creature no longer. It was not only ruinous to the traffic, but the cost to work that traffic with anything like regularity was enormous. It was not abandoned, however, on account of the difficulty of junction with other lines, for it was quite practicable to effect this by covering over the rope at the points of junction. The rope, however, was perpetually breaking, and horses had to be kept ready to bring it home after the difficulty of catching the broken ends had been accomplished. The introduction of the rope system on that line had caused an addition to the capital of the company of not less than £100,000; and, after every possible material for the rope had been tried, all of which failed, it was happily abandoned for the system of locomotive traction. He considered the motive power ought to accompany the train, and he believed the right thing to do was to deal with the locomotive itself, and endeavour to modify its construction so as to meet the requirements of the new system of railways that had been commenced, but he earnestly begged them not to return to the rope system.

Mr. Burnett thought the alleged deterioration of the atmosphere in the tunnels of the Metropolitan railway had been much exaggerated. He referred to the fact of the enormous traffic which was daily carried on that line, as a proof that it was not viewed with disfavour by the public, and remarked that if the engines which ran from the lines in connection with the Metropolitan were as free from the vapours of combustion as were those employed by the company, there would be no cause of complaint on that account. With reference to the alleged vitiated atmosphere in the tunnel stations, he would state that fans were introduced to bring down the good air from above, and drive off the bad air from below; but after they had been a little time in operation the officials begged they might be removed, as it was questioned whether the air brought down was not worse than that which existed in the tunnel.

Mr. Joseph Smith remarked that the fact was lost sight of that the journey from Bishop's-road to Farringdon-street was accomplished in eighteen minutes, which was a very short time to pass in even a confined atmosphere. He should be sorry to be left in one of the tunnels of the Metropolitan line as he had often been on the Blackwall through the failure of the rope system.

The Chairman said it now became his duty to ask the meeting to accede to a vote of thanks to Mr. Barlow for the interesting paper with which he had favoured them on a subject which was exceedingly important, not only to engineers, but to all who travelled by railways, especially on the metropolitan lines. It appeared that Mr. Barlow had brought before them a system, novel in many respects, though not essentially so. Mr. Barlow had told them that on a line where the stations were very frequent, they might with advantage employ a means of propulsion that was not available where the stations were more distant apart, and where the length of rope required would be exceedingly great, and had maintained that, by employing fixed engines and using rope for short distances, there would be a great saving of engine power, and reduced expenditure in the general working of the line. He had also shown that by taking advantage of accumulated momentum, an economy of power and an increase of speed could be obtained, but he had omitted to notice the important consideration of securing a much purer atmosphere within the tunnel. They must recollect that, in the construction of lines for which the sanction of Parliament had already been obtained, tunnels of greater length than anything they had on the Metropolitan would occur. This would be the case on the line from Victoria-street, under the Thames embankment, to Blackfriars, and also on the proposed East London line, of which the Thames tunnel was to form a portion, and these being at much greater depth from the surface rendered the question of purity of atmosphere a still more important one. It was one of those engineering problems which should meet with full and careful consideration. It was satisfactory to find the calculations of Mr. Barlow supported by two able mathematicians, Mr. Imray and Mr. Vignoles. They were told that a great objection to fixed as compared with locomotive plant was the liability of derangement in the machinery, but this fear was originally expressed with regard to steamers, and yet those who had taken long sea voyages must have been struck with the undisturbed regularity with which the engines of steam vessels were worked almost without cessation for weeks together, which was sufficient, he thought, to dissipate all fears in connection with derangement of machinery. With regard to casualties, it should not be forgotten that it was proposed to have duplicate engines and therefore the chances of a serious break down in working this system were very trifling. He apprehended the purpose of this discussion was to ascertain the real merits of this system, for it must be remembered that we had to deal with what might be termed an entirely new class of railways, and therefore some improvement in the present mode of working seemed to be required. He confessed he hoped this was only one of many discussions which they would have in this room by which they might find a better mode of travelling underground than any hitherto adopted. Mr. Johnson argued from the large number of persons who travelled on the Metropolitan railway, that the system was as good as it could be, but if a better system were introduced he (the Chairman) contended more people might be induced to use the line. He concluded by moving a vote of thanks to Mr. Barlow for his paper, which was carried unanimously.

Mr. Barlow, in acknowledging the compliment, said he would endeavour to answer the objections that had been brought against this system of propulsion. With reference to the Metropolitan Railway, he had said very little about that line in particular, but he had said he thought locomotives were generally very cruelly treated on lines with frequent stations, and on the Metropolitan line that cruelty was carried to the greatest extent, inasmuch as the locomotive was prevented from breathing whilst going through a tunnel, in order that the passengers themselves might be able to breathe. With regard to the figures given by Mr. Colburn about traction, he thought that gentleman must have mixed up those figures with something in which he had been engaged on the other side of the Atlantic, as they had nothing in this country in the way of traction that agreed with his statements. With respect to what had fallen from Mr. Chubb relative to the system of rope traction formerly employed on the Blackwall line, it was no argument that because a thing had failed under certain conditions, it should not succeed under entirely different conditions. He (Mr. Barlow) had had very considerable experience in rope traction, and he was acquainted with all the difficulties connected with it. He was aware of the loss of mechanical power which was occasioned by the rope; but in the case of the Blackwall railway the great wonder was that it ever worked at all. It was a rope more than three miles long; and the difficulty of working a rope increased by more than the square of the length; so that it was no argument to say that because a rope of three miles failed, therefore a rope of three hundred yards could not succeed. With regard to the starting of the train, it had been objected that under the rope system there would be an unpleasant jerk, but this was not so much the case as under the present system, for with locomotives the couplings of the trains were frequently slackened when it was standing at a station, and the result was, when they put on the steam each carriage received a jerk at starting. He had been assured by Sir William Armstrong and other eminent practical men

whom he had consulted on this subject, that under this system a train could be started more gently than by a locomotive. The rate of speed at which it was proposed that the train should be started, was not necessarily higher than under the present system with a locomotive on a descending gradient. Moreover, if by the rope system they could make the uphill start and travelling as good as the downhill at present, they would effect a material improvement. Besides, when it was considered that under this plan of propulsion trains could be run every three minutes, they would not have such heavy trains to deal with as at present. On the subject of rope traction he would say, further, he believed he was the first to abandon it on the Whitstable branch, and the example was followed on several other lines, including the Glasgow; but, in the latter instance, they were obliged to come back to the rope again; and for a distance of nearly a mile and a quarter a large passenger traffic was carried on by rope traction at the present time, and hence it could not be contended that any practical difficulty would arise with a rope of 300 yards. Objection had been made to the rope system on the ground that it interfered with junctions; but the proposed mode of applying the rope traction for short distances entirely obviated this difficulty.

DUBLIN INTERNATIONAL EXHIBITION, 1865.

Austria is making strenuous efforts to be well represented at the Dublin Exhibition, and it is to be hoped that the new commercial treaty which is now being negociated with that empire will tend to a largely extended trade on both sides, when the existing fetters to commerce are removed. Austrian manufacturers did exceedingly well at the London International Exhibition in 1862, for, besides gaining great honour, extensive sales were effected. Already it is said that Chevalier de Wertheim and Co., the celebrated workers in metal, will have a very fine display, with photographs of their works; and that Neustadt, of Prague, will send works in the precious metals. The porcelain by Fischer, which attracted so much notice in 1862, will be well represented. C. Kronig, of Vienna, will exhibit papier-mache furniture, in addition to objects in carton pierre, and fancy articles in wood. Messrs. Thonet Brothers exhibit bent wood furniture, for which they received a medal in 1862. M. Klein will send a magnificent collection of leather work, rivalling the one exhibited under the western dome in 1862. Meerschaum pipes and amber carvings will be shown, and there will also be a good collection from Austria of musical instruments, glass, clocks, oil paintings, photographs, and photographic apparatus, wines, and agricultural produce.

NORTH LONDON WORKING CLASSES INDUSTRIAL EXHIBITION.

The distribution of prizes awarded to the successful exhibitors at this Exhibition, held at the Agricultural Hall, Islington, took place on Monday evening, the 16th instant, at Exeter Hall. The Right Hon. the Earl of Shaftesbury, K.G., occupied the chair. A tonic-sol-fa choir, under the direction of Mr. Sarl, sang several pieces of sacred music.

The meeting was briefly addressed by Mr. T. B. Smithies, Mr. Samuel Morley, and Deputy-Judge Payne.

The list of successful exhibitors, with the names of the prize volume or article awarded to them, was then read, and the recipients, passing along the front of the platform, received from the hands of the Chairman the prizes they had gained.

The Earl of Shaftesbury said, in reference to the prizes, that never were rewards more honourably won. The working men had come forward generally to show what their class was capable of—what high aspirations and great powers they possessed, if only opportunities were afforded for their development. Such manifestations would not only be of benefit to the working classes themselves, but also of great and lasting benefit to the whole of the British empire. On behalf of the public, he would say that the public came forward to thank the working men in the same spirit in which they had contributed to the happiness of the whole British people. A remarkable feature of the Exhibition, and of that which preceded it, was the large proportion of works wrought by men not producing articles in their own department of industry—persons of different capacities had produced results of a character totally different to the trade in which they were engaged. The conclusion he drew from the Exhibition showed the necessity of a variety of occupations, and the earnest desire and craving for mental recreation amongst the great working class. Let the evening of the working man be devoted to the exercise of his genius, and to everything which could improve him morally and raise him in the social and political scale. He regretted to hear it suggested, with some degree of authority, that in all future Exhibitions of this kind—and he trusted they would be many—all exhibitors should be confined to the particular department of industry in which they were daily engaged. This would be undesirable. The object of such exhibitions was social rather than financial, and moral rather than commercial, for it was to hold out a healthy, joyous, and noble recreation to the working classes—to break and embellish the monotony of toil—to give a free safety-valve to genius and taste, and to that which, if not rightly indulged, would be hurtfully indulged, namely, the power of the imagination. Such exhibitions tended to improve the conditions of social life, give dignity to domestic life, and throw over home all the allurements possible—to induce working men to give up the habits by which so many were degraded, and by the cultivation of their genius and the exercise of the affections, to make the family-hearth happy.

Mr. W. H. Bodkin (Assistant-Judge) proposed, and Mr. Harvey seconded, a vote of thanks to the noble chairman, which was carried by acclamation.

PROTECTION TO INVENTORS IN INDUSTRIAL EXHIBITIONS.

On Tuesday, the 17th inst., a deputation on this subject was received by the Right Hon. M. Gibson, President of the Board of Trade. The request for an interview originally came from the committee of the West London, late Borough of Marylebone, Working Men's Industrial Exhibition; but, at their invitation, gentlemen connected with other similar exhibitions joined the deputation. Among those present were—Mr. R. M. Morrell, secretary to the West London Exhibition; Mr. Murphy, South London Exhibition; Mr. Ratley, one of the honorary secretaries to the North London Exhibition; Mr. G. J. Knight, East London Exhibition; Mr. Christie, secretary to an Exhibition to be opened at Birmingham in August; the Rev. Eardley Wilmot, Mr. J. A. Nicholay, Mr. Peter Graham, &c.

Mr. Harvey Lewis, M.P., introduced the deputation.

Mr. Morrell said there had hitherto been no system of communication between different districts with respect to these industrial exhibitions, but he now found that in every district the same difficulty had been experienced as that which the promoters of the West London Exhibition had to contend with. They were asked at the very outset whether they could afford protection to inventors who might exhibit, but who were too poor to obtain a patent, and who, by exhibiting without that security, might find themselves robbed of the fruits of their ingenuity and labour. Of course they were most desirous of affording such protection on the simple ground of justice, as well as expediency, for they soon found that unless such protection was given, the most valuable inventions of working men would be entirely withheld. The subject had been so strongly brought before them at many meetings, tha they felt compelled to move in the matter, and, as a result

of their exertions, the Right Hon. Mr. Cowper, First Commissioner of Works, and Sir Roundell Palmer had both taken the subject up. It was, indeed, by the recommendation of the Attorney-General that they waited upon the right hon. gentleman in his official capacity, to ask him to introduce a short bill into Parliament for the purpose. The Attorney-General had stated his willingness to assist in the preparation of such a bill, and to take charge of it if it had the sanction of the Government. He urged upon the right hon. gentleman that there could be little difficulty in acceding to this request. That protection had been accorded to the inventors who exhibited at the Great Exhibitions of 1851 and 1862, and surely there could be no objection to do the same for the industrial exhibitions that were now springing up all over the country. He did not apprehend that on public grounds there would be any objection to such a measure, and he was sure that it would bring out hundreds of working class exhibitors who would otherwise withhold their inventions.

Mr. Christie, of Birmingham, Mr. Murphy, of the South London Exhibition, and other gentlemen urged the importance of the measure.

Mr. Nicholay expressed his confident expectation that the Government would accede to the request of the deputation, and give to the poorer classes of inventors the same protection as they had given to wealthy inventors at the Great Exhibitions.

Mr. M. Gibson said that if he understood the deputation clearly their immediate object was to get some bill brought in which would prevent any working man exhibiting at those exhibitions being prejudiced by such exhibition, or deprived of the fruits of his toil and ingenuity. That he understood to be their immediate object, and it was a very simple one. But there was one point to consider. How would they define which of these exhibitions was to have the benefit of the protection they asked for? In the case of the Exhibition of 1862, and the act they referred to, the matter was very simple, because that Exhibition was under the control of a special commission, and could, therefore, be specifically referred to. The difficulty in this case would be to find some title which was sufficiently general to cover the whole ground, and at the same time not go beyond the real object aimed at. He would be most happy to give the matter his best consideration, and should the Government sanction it, he had no doubt the Attorney-General would give his assistance, and take charge of any bill that might be introduced.

Mr. Peter Graham suggested that a certificate from the Board of Trade would be a sufficient warrant for putting the provision of a general act in operation.

Fine Arts.

A Medallion of the Poet Laureate is now being published by Mr. Moxon, the publisher, which may possibly run through as many copies as the poems, that are perhaps scarcely more the exponents of the great poet's mind than is this medallion the reflex of his mind-moulded features. The likeness is more striking than ordinary medallion-likenesses are, not only from the extreme accuracy with which the work is executed, but on account of this medallion (unlike most medallions) being taken in "three-quarters" instead of in "profile." There is, moreover, great "relief" gained by the employment of a concave ground, which not only negatives the possibility of these cast-shadows that disfigure most medallions (and give them the appearance of "a split-jowl" adapted by its cut-surface to a flat ground), but, at the same time, allows of a very considerable amount of side light, much more than is obtainable in profile medallions. It is intended that this likeness of Tennyson be produced at a very reasonable price, both in electro-bronze and in plaster of Paris, and Mr. Woolner, the sculptor, and friend of Tennyson, has entrusted the entire management of this novel undertaking to the judgment of Mr. Moxon.

Commerce.

Tea Supplies.—The following is from Messrs. Lloyd, Matheson and Co.'s annual statement:—The total imports to the United Kingdom amount to 122,600,000 lbs., against 136,000,000 lbs. in 1863. The total deliveries are 116,100,000 lbs., against 112,100,000 lbs., of which the home consumption is 88,200,000 lbs., against 85,000,000 lbs.; and the foreign export is 27,900,000 lbs., against 27,100,000 lbs. in 1863. The total stock in the United Kingdom on 31st December was estimated at 95,200,000 lbs., against 88,700,000 lbs. in 1863. The imports to Liverpool, direct from China and Japan, for 1864 are only 1,600,000 lbs. It is gratifying to observe a steady increase in the home consumption, which, though perhaps not fully up to the sanguine expectations of some, is fully 10 million lbs. increase on the figures before the reduction of the duty to 1s. per lb. The foreign export also appears steadily on the increase, at least as regards the continent of Europe; for notwithstanding the much diminished sendings to America during last year, the total exceeds the figures of the preceding year. With all the increase, however, the total deliveries do not come up to the liberal supplies which have reached this country from all quarters. From China and Japan we have received 116 million lbs., while India has sent about three million lbs.; and these, with occasional supplies from America and other countries, bring the excess of imports over deliveries to quite six million lbs. It is now evident that the reduction of duty has had the effect of stimulating the consumption of good to fine grades in each description of tea. These grades throughout the year have not been oversupplied; and, generally speaking, teas with quality have been readily saleable on arrival, not always at prices remunerative to importers, but at rates which were not materially below the average prices of similar grades in former years. We may here remark that while the demand has been stimulated for the the finer qualities, the production in China appears to have deteriorated. The proximity to the producing districts at Hankow has evidently caused a rapid and careless preparation of the blackish leaf teas, but from one cause or another the quality of most of last year's, and so far of this, shows a decided falling off; there is a want of ripeness and evenness of quality in the chops, and the leaf is ragged and badly picked. The Foochow teas are not so much fallen off, as this season's fine show a decided improvement in real quality over last, if we except the Packlin sorts; but the lower grades of the first crop are decidely inferior. What is most to be regretted in connection with this depreciation in quality is, that buyers in China appear, in the majority of cases, to have paid for these teas as if they had been really fine, hence, both last year and this, differences of 4d. and 6d. per lb. were not unfrequent, not arising from a depreciation in the home market, but solely from the mistaken view of the quality abroad—as if tea was bought by its class, instead of by its intrinsic quality.

Indian and Japan Teas.—Messrs. Arthur Capel and Co., in their circular, state:—"Indian teas continue to be in great favour with the trade, owing to the general inferiority of the China crops; and the fine, strong, pungent kinds have sold dearer than ever; whilst the common, weak, and sour kinds have been generally difficult of sale, not being good enough for the purposes of admixture, for which they are mostly used. It is quite evident that if proper care in the cultivation and curing of Indian tea is taken, the result will prove a great success to all interested, as it only requires the superior strength and quality to be maintained to insure a ready sale at remunerative prices. Japan teas, as long as the demand

from America lasted, sold very readily at full prices, but they do not meet with favour from the home trade; and since the export to America has ceased they have been very difficult of sale. We fear that unless they can be made to assimilate more to China teas, either black or green, they will be always uncertain of sale, as they are entirely dependent on the American demand, which in the present position of affairs is liable to great fluctuations. The coloured kinds early in the year realised extreme prices."

The Earthenware Trade with the United States.—Mr. T. H. Masters, of Liverpool, states that the annexed report shows at a glance how the earthenware trade with the United States has been going on during the war there, compared with the preceding years 1859 and 1860, which represent the usual extent of exports in ordinary times. The excessive falling off in 1861 may be ascribed to the ample stocks held by merchants and dealers at the beginning of that year (the first of the war) as compared with the demand which was looked for during the remainder of it, and also to the financial confusion which was expected to arise immediately upon the commencement of hostilities between the North and South. The exports of last year figure very satisfactorily when it is borne in mind that American importers have been surrounded by every species of impediment. The uncertainty which hung over the presidential election materially checked shipments during the latter part of the year, but recent advices indicate the prospect of a fair amount of business during 1865, unless some unforeseen events occur to prevent it. The following is a comparative statement of exports of earthenware from Liverpool to the six principal ports of the United States during the past six years:—

	1859.	1860.	1861.	1862.	1863.	1864.
To	Pkgs.	Pkgs.	Pkgs.	Pkgs.	Pkgs.	Pkgs.
New York...	43,217	43,920	15,649	30,495	33,434	37,143
Philadelphia	13,390	13,780	5,089	10,762	10,354	12,147
Boston	16,599	18,955	7,024	8,747	10,283	12,550
Baltimore ...	2,194	2,107	340	869	243	587
Charleston...	3,020	2,188	158	...	...	...
New Orleans	15,811	14,510	1,494	...	771	594
Totals...	94,231	95,460	29,754	50,873	55,085	63,021

In January, 1859, exchange at New York for bankers' bills on London was 106, and the Bank of England minimum was 2½ per cent. In the last week of 1864, exchange at New York for bank bills on London was 238.

Telegraphic Extension and Reform.—Very great progress has of late been made in this important matter on the continent. The French Government has just placed the electro-semaphoric posts on the coast in connection with the general telegraphic system, so that messages may now be despatched and received at these outposts in the same manner as in the towns. The *Moniteur* has just published a complete list of these semaphores and of the more important places situated within the vicinage of each. Another very important announcement has just appeared in the same journal, containing the results of recent conventions made between France and foreign governments. According to the new arrangements the cost of a message between any of the offices of France and the Papal States is now 5 francs for twenty words, and half that sum for each additional ten words; between France and Prussia, east of the Weser and Werra, 4 francs and 2 francs; between France and the Rhenish Provinces, and also between the former and Baden, 3 francs and 1½ franc. The importance of these conventions will be best understood by a few instances. A message between Paris and Rome will cost 5 francs instead of 13fr. 50c.; one between Paris and Cologne, 3 francs instead of 7fr. 50c; between Paris and Berlin, 4 francs instead of 12 francs; between Marseilles and Dantzic, 4 francs instead of 15 francs; between Bordeaux and Memel, 4 francs in place of 18 francs; and between Toulouse and Carlsruhe, 3 instead of 9 francs.

The Coffee Trade.—Messrs. Truman and Rouse, in their circular, state the stock of coffee in the principal entrepôts in Europe and Great Britain, on the 30th November, was 53,170 tons against 59,750 and 49,930 in 1863 and 1862. The deliveries in Holland continue satisfactory, being for the past year 890,400 bags against 725,700 in 1863, and the consumption in Europe generally appears to be fully up to that of last year. Looking forward to the prospects of coffee in 1865, there is every reason to anticipate a steady trade, and the continuance of remunerative prices to the planters in Ceylon and Madras, although, regarding the fact that both these countries will yield a considerably greater supply, it would be scarcely safe to reckon on so high a range of quotations as those of 1864. The shortness of the Java crop will, however, help us, as the demand for clean coffee on the Continent is evidently increasing. As respects Brazil the prospects are not so encouraging; the new crop will undoubtedly be large, and unless the consumption in America increases, the supply will probably be found somewhat too heavy for the European markets. The home consumption in Great Britain last year was but 16,530 tons, being 670 tons below the average of the previous two years. The increased use of coffee does not keep pace with that of tea in England.

Ceylon Coffee Production.—The following returns of the Ceylon Coffee Crops are extracted from the *Colombo Observer*:—Although the crop for season 1863–4 was very much smaller than that of 1862–3, yet, with that exception, it was the largest known:—

Total Crops of Coffee in Ceylon to the end of the Season (30th September) in the last Five Years.

Years.	Plantation.	Native.	Total.
	Cwts.	Cwts.	Cwts.
1860	472,618	160,241	632,859
1861..........................	466,987	136,190	603,177
1862..........................	414,298	170,824	585,122
1863..........................	582,528	204,973	787,501
1864..........................	516,862	137,949	654,811
Total for Five Years..	2,453,293	810,177	3,263,470

The whole crop may now be said practically to have been shipped to London . . . This is rather a change since 1859–60, when out of a crop of 632,000 cwts., 130,000 went to countries other than England . . . If the figures received from Java and Brazil can be depended on, the out-turn of crop 1863–4 in the three great coffee countries of the world is as follows:—

	1863-4.
Brazils	2,800,000 cwts.
Java	795,000 ,,
Ceylon	654,000 ,,
Total	4,249,000 cwts.

Coffee cultivation is rapidly extending in Ceylon . . . As a probable out-turn of 900,000 cwts. of coffee is admitted for the season 1864–5, going on all former experience it seems pretty certain that the annual million will be made up or exceeded for the next five years. Indeed, it would not be extravagant to anticipate an export of two millions in 1870.

Wines.—Messrs. M. Clark and Sons, in their Annual Circular, state that the trade in wines and spirits, which has gradually progressed since the reduction of duty, has made a most marked and decided step in the past year, and while the imports have been somewhat excessive, and leave a heavy stock on hand at the present time, still the home consumption shows so great an increase as to justify the conclusion that the bonded stock is but little above the requirements of dealers, and may speedily be reduced, if importations are moderate, by the deliveries during the next two months. The past year has been the largest in imports and deliveries that we have yet had, and compared with the average rate of delivery under the

old scale of duties, the home consumption of wine shows an increase of fully 66 per cent. This increase is the more remarkable, as it has been maintained throughout the year, in the face of monetary pressure and commercial disaster, added to the fact that prices of several descriptions of wines have ranged considerably higher than formerly.

Colonies.

Sugar in Queensland.—A very excellent sample of sugar has been shown, produced at the plantation of the Hon. Lorys Hope Cleveland. It is a portion of three tons of dry sugar and fifteen hundredweight of molasses, the produce of less than one acre of purple cane. Some inquiries have been made respecting the market value of this class of sugar, which is variously estimated at from £38 to £41 per ton. Mr. Strachan, the manager of the plantation, states that the canes from which it has been produced are the first that have been fully ripened, and that have had a fair trial given them since the formation of the plantation, and that he anticipates a much larger yield from future crops, as he intends to plough much deeper. He also states that at a small additional expense he believes that the sugar can be further refined, and rendered much more valuable. It is very gratifying to see so good a result of the work at the Cleveland station, and is a subject for much congratulation to Capt. Hope, It is also a matter of congratulation to the entire colony, as it must establish, even in the mind of the most sceptical, the sugar-growing capabilities of Queensland.

Railways in New South Wales.—Tenders have been called for the Great Southern Extension, which will carry the railway into the town of Goulburn. The length of the line will be twenty-six miles twenty-seven chains, and it is to be let in one contract. There will be a number of heavy cuttings, but the most formidable works will be the bridges across the numerous rivers and creeks. Close to Goulburn there is to be a tubular girder bridge, over the Mulwaree Ponds, with twelve openings of sixty feet. It is not decided whether the piers are to be of stone or brick; prices for both kinds of work are to be given, and that which is found the most economical will be adopted. The line will twice cross the Wollondilly River; the bridge at the first crossing will have seven openings of sixty feet, and one of 130 feet; that at the second crossing will have six openings of sixty feet, and one of 130 feet. At Barber's Creek there will be a bridge with five openings of sixty feet; that at Box's Creek will have two openings of sixty feet. Excepting that at the Mulwaree Ponds, all of hese bridges will have single-web iron girders; the piers to be of stone or brick as may be found most economical. Over several other creeks there will be large viaducts, mostly of timber. The ballasting and the permanent way will be included in the contract, for the performance of which three years will be given.

Alpacas for New Zealand.—The *Wellington Independent*, of 29th Sept., says—"It is understood that his honour the Superintendent has succeeded in purchasing for this province ten alpacas, eight females and two males, and that they may shortly be expected from Sydney by one of the S. R. M. Company's steamers. This will be a great boon to the province, and as the climate and nature of the country are said to be peculiarly adapted for alpacas, we have no doubt they will thrive well, and that in the course of a few years the wool of the alpaca will form a considerable item in our exports."

Obituary.

It has been remarked that the past year was a fatal one for artists and men of science on the Continent; certainly the list of the departed is long and melancholy. France has lost from the ranks of art the following eminent painters:—Alaux, member of the Institute, and formerly Director of the French School at Rome; Hippolyte Flandrin; Du Bufe, the elder; Allard, assassinated by one of his models at Rome; Ménissier, killed by a fall from the scaffold on which he was working in the church of Saules; Roehn, Mathieu Rivoulon, Pottin, Barbier, Besson, and Leopold Lobin, director of important stained glass works at Tours; the sculptors, Louis Brian, Aristide Husson, a pupil of David d'Angers, and author of a large amount of busts and decorative sculpture; Christophe Féatin, a clever modeller of animals; and Justin; the architects, Lusson, formerly engaged on public works in Paris, who has left his collection of drawings and plans to the Museum of Mans; Ménager, who won the Grand Prize of Rome at the early age of 18, and executed many public works; Azémar, the designer of some fine mansions in Paris; Boullé, of Rennes; Querry, of Moulins; Segrétain, the restorer of many fine churches in the Department of the Deux Sèvres; Pellegrini, of Chambery, who built the baths and casino of Aix, and whose death is said to have been hastened by the vexation caused by the loss of all his plans, drawings, and sketches, in the fire that consumed the theatre of Chambery; Jules Gagniet, a well-known illustrator; and the engravers, Achille Lefèvre, who exhibited great talent in reproducing the works of Raphael and Coreggio, one of his last productions being an engraving of the "Antiope," ordered for the chalcographic establishment attached to the Louvre; Deschamps, of Marseilles; and Godard, engraver on wood, and conservator of the Museum at Alençon. The French Institut, besides Alaux and Flandrin, mentioned above, lost Ampère, Clapeyron, A. Garnier, Hase, Arnaud-Lefebvre, and Admiral Du Petit Thouars. Amongst savans may be mentioned, Professor A. Cochet, chemist; A. Digot, author of the "Archæological History of Lorraine," twice crowned by the Academy; Dinaux, archæologist; and Savalle, inventor of the well-known apparatus for distillation which bears his name. The following are amongst the most notable names in the obituaries of other countries:—The Marquis Costa de Beauregard, of the Imperial Academy of Savoy, and the Turin Academy of Sciences; Dr. Gerling, Director of the Masbourg Observatory; the Greek savant, Bona; Professor Casper, of Berlin; Franklin Bache, the great grandson of Benjamin Franklin; Peretti, the Roman chemist; Rudolph Wagner; Barnontz de Jassy; Hohenegger, the geographer of the Carpathian mountains; the learned Dane, Charles Rafn; Struve, the Russian astronomer; the traveller Junhung; the Hebrew linguist, Rabin Sachs, of Berlin. Amongst painters, Germany lost R. S. Zimmermann, of Bavaria; Belgium, Gustave Pierron, Henri Julien de Stoop, of the Academy of Brussels, and Charles Robert, killed while hunting; and Switzerland, the celebrated landscape painter Calame, the illustrator of the Upper Alps, famous also for his etchings and lithographs. Belgium has also lost the architects Roeland, Professor at the University and Schools of Art, who built the Palais de Justice, the University, the theatre and casino of Ghent, and an immense number of hospitals, churches, and other public buildings, in various Belgian towns. Rome lost, amongst other artists, Rafaelle Castellini, Director of the Mosaic School attached to the Vatican, and who executed the wonderful works, the "Sybille de Cumes," after Domenichino, and "Saint Jean Baptist," after Guercino, which appeared at the Great Exhibition of 1851, and now are at the Tuileries.

Publications Issued.

A Treatise on Ordnances and Armour. By Alexander L. Holley, B.P. (*E. and F. N. Spon.*) This includes descriptions, discussions, and professional opinions concern-

ing the material, fabrication, requirements, capabilities, and endurance of European and American guns for naval, sea-coast, and iron-clad warfare, and their rifling, projectiles, and breech-loading; also results of experiments against armour, from official records, with an appendix referring to gun cotton, hooped guns, etc., etc. There are 493 illustrations.

Journal of the Proceedings of the Linnæan Society. Vol. viii., No. 30. (*Longmans.*) Contains the following papers:—The Œsophagus of the Ruminantia, by Wm. Rutherford, M.D. Description of New Species of Hymenopterous Insects, from the Islands of Sumatra, Sola, Gilolo, Salwatty, and New Guinea, collected by Mr. A. R. Wallace; by Mr. Frederick Smith. Account of a Heronry and Breeding-place of other Water Birds in Southern India; by John Shorter, M.D., F.L.S. Brief account of the Myrmica Kirbii, as found in Southern India, by John Shortt, M.D., F.L.S. Description of New Species of the Dipterous Insects of New Guinea; by Francis Walker, F.L.S.

The London, Edinburgh, and Dublin Philosophical Magazine. Fourth Series. Vol. 29, No. 193. (*Taylor and Francis.*)—The January number contains articles as follow:—"Researches on the Mineralogy of South America," by David Forbes, F.R.S.; on "The Relative Heating, by Solar Radiation, of the Soil and of the Air, on a Mountain and in a Plain," by M. Charles Martens; on "A Case of Stereoscopic Illusion," by C. J. Monro; note on "A Quartic Surface," by A. Cayley, F.R.S.; on "The Approximate Graphic Measurement of Elliptic and Trochoidal Arcs, and the Construction of a Circular Arc nearly equal to a given Straight Line," by W. J. Macquorn Rankine, F.R.S.; on "Calcescence," by Dr. C. K. Aikin;" on "The History of Negative Fluorescence," by John Tyndall, F.R.S.; note on "The History of Energy," by P. G. Tait, M.A.; on "Thermal Radiation," by Professor Magnus; on "The Work or Potential of Torsion: New Method of Establishing the Equations which regulate the Torsion of Elastic Prisms," by M. de Saint Venant; the proceedings of learned societies, and intelligence and miscellaneous articles.

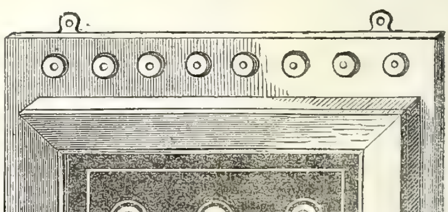
Notes.

The Memorial to H.R.H. the Prince Consort.—The massive blocks of granite intended for the base and pedestal of the Memorial to His Royal Highness the Prince Consort, have arrived at Limehouse. The blocks are about to be polished at the works of Mr. Kelk, the contractor for the erection of the Memorial, and when that operation is completed they will as speedily as possible be placed in position. So massive and weighty are these blocks in their undressed form that their removal from Limehouse to Hyde-park was an object of considerable mechanical interest. The stone is said to be of singular beauty, compactness, and durability. It is taken from the quarries of the Scottish Granite Company, in the Isle of Mull. It is of a beautiful pink-red colour, capable of a polish equal, if not superior, to the finest marble, while it possesses in abundance all the properties necessary to enable it to resist the chemical action of the atmosphere. In a climate like ours, and for such an object as this National Memorial, the property of resisting the action of the atmosphere is one of supreme importance. Several of the lighthouses on the West coast of Scotland, which have stood the test of innumerable storms and the action of the severest frosts, are constructed of this granite. It has also been used in the construction of various harbours of refuge, in the building of the Liverpool Docks, the harbour works at Greenock, in the foundations of Westminster Bridge, and for the foundations of the Thames Embankment. The monolith or obelisk originally proposed for the Memorial was to have been taken from these very same quarries. The same stone has been selected for the immense red granite columns forming part of the designs of the new bridge at Blackfriars.

Celtic Relics.—The Museum of Vienna has just received from M. Karl Zugmayer, of Waldeck, in Austria, an interesting collection of utensils and ornaments, in metal, found in the hollow of a rock, beneath a layer of granite. There seems little doubt that the objects in question are of Celtic origin. Amongst the most remarkable articles are two golden discs, a number of double spirals, arranged in the form of opera glasses, very carefully made, but of which the application is not even guessed at, some bracelets, and two heavy copper hatchets. The discs are respectively about five and six inches in diameter, and weigh together thirty-five golden ducats. They are ornamented with several rows of precious stones. They are believed to be the insignia of chiefs or priests, who wore them on their breasts. Some few years since a number of other precious objects, belonging to the earliest time of the Christian era, were found at Muthmansdorf, a village near which this new discovery was made.

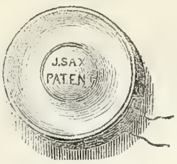
Electric Bells and Fire Indicators.—Some time since an ingenious electric tell-tale, invented by Mr. Sax, was noticed in the Society's *Journal.* He has now perfected an arrangement by which a bell is rung by the electric current, and at the same time a disk is brought to view, showing from which room the signal is sent. It consists essentially of an electric bell, which is placed in a situation where it may be seen by the persons whose attention it is wished to call. Near this is suspended the indicator shown at Figure 1. In the room or rooms from which the messages are to be forwarded, several buttons, represented at Figure 2, are placed against the wall: these correspond in number with the indicator; on pressing one of these buttons with the finger, the bell, however distant, is rung loudly, and a central red disk, as shown at numbers 1, 3, and 5, of the indicator, makes its

Fig. 1.



appearance. It is obvious that if the press buttons are situated in different rooms, the attendants, seeing the numbers marked on the indicator, are at once made aware of the room from whence the signal proceeds. If desired, the whole of the press buttons may be placed in one room, and made to signal different messages; thus, instead of the red disk, the name of the person or article required may be shown at the apertures of the indicator. For example, from the bar of an hotel, the waiter, ostler, boots, or chamber-maid, etc., could be called as required. The bell continues ringing so long as the button is kept down.

Fig. 2.



In addition to the multifarious uses to which this indicator, as thus constructed, could be applied, it may readily be made available as a fire indicator, and this is effected by a modification of the press button shown at Figure 2; this contains a metallic thermometer, which can be set to any temperature desired; and when that degree of heat is exceeded, it makes the contact, completes the electric current, and causes the bell to ring violently so long as the high temperature remains. It thus becomes a fire alarum, ringing its signal of danger from any room or warehouse where it may be placed, to the sleeping apartment of the manager or superintendent. The fire button can also be made to act on a reduction of temperature below any given degree, and if then placed in a hot-house would call the attention of the gardener to the sudden occurrence of a frost, which, if unnoticed, might destroy the results of many months' care and attention.

The Farmers' Club.—The subjects to be brought forward for discussion during the present year include—"Middle-Class Education," to be proposed by Mr. E. Edmunds, of Rugby; "The Breeding and Management of Pigs," by Mr. S. G. Stearn, of Brandeston, Wickham Market; "The Management of Grass Land," by Professor Coleman; "The Importance of Shelter and Covering to the Farm and the Homestead," by Mr. J. Bailey Denton; "The Management of Benefit Societies in the Rural Districts," by Mr. Charles Howard, of Bedford; and "The Breeding and Management of Cattle," by Mr. T. Duckham, of Baysham Court, Herefordshire. A silver cup, of the value of not less than ten guineas, will be awarded by the Committee for the best paper read during the year.

Correspondence.

Art-Workmanship. — Sir, — An inspection of the specimens of Art-Workmanship now exhibiting at the Society's Rooms, afforded me great gratification, as showing that in those applications of the Fine Arts which are the most available for domestic adoption, a high tone and completeness of detail is evidenced to such an extent as testifies that we are in a very hopeful state in regard to the branches of the Fine Arts represented at the Exhibition. The wood carvings and the specimens of mosaic work especially attracted my attention, for it struck me that these two branches of art are of such a character that, although for the execution of grand works we must, of course, resort to great masters and expensive materials, yet much that is pleasing and profitable might be produced by the comparatively untutored man of genius; and it occurred to me that it would be very desirable if the Working Men's Exhibitions, which are now springing up around us, were to direct the attention of our working men to the production, from suitable designs, of wood carvings (not in expensive woods) and mosaics worked in cheap materials; moreover, the kindred art of marquetry and inlaid work, as applied to articles of furniture, would most likely be very successfully pursued by our artisans and their families. It would certainly be much more desirable that a man should devote his leisure hours to the production of decorative furniture and ornamental objects for the house than to spend unnumbered years in stitching together small pieces of fabric to form a patchwork bed coverlet, or to the production of things of the ordinary type and character, of an uncouth appearance and unartisan-like finish. In all these branches of art that I have recommended, if we eschew elaborate productions, much may be done with so simple a tool as a sharp penknife or cutting instrument. What is wanted is the publication of suitable designs, with some simple and pertinent directions for the worker; possibly the announcement of some prizes for the best specimens of amateur work would facilitate progress. Even if the works produced by the amateurs should be of little value (though if the effort be sustained they must eventually be of some value), yet the practical acquaintanceship with art which will result must be a public good. It will, at any rate, be adding a new source of pleasure to the people's enjoyments, and eventually be of advantage to our artists, as it will increase the circle of those who consider the acquisition of objects of art as almost things of necessity; and, in any case, amateur workers must find instructive amusement in their work.—I am, &c.,—T. W. Campin.

London, 11th January, 1865.

Art-Workmanship.—Sir,—I was unable to attend on the 2nd inst. to make a suggestion, and beg most respectfully to do so by letter, viz., that one of the prizes should be for apprentices only, with less work than the present piece of ornament, as the masters generally will not give them any time (Messrs. Hunt and Roskell being a most liberal exception) to compete, and it is taxing their leisure too much to take about three hundred hours from it in six months. This is one of the causes of there being so few; it would also induce many more to try, if they were all youth, the timid would try as well as the more confident. It has been suggested that the selection of subjects should be left to the workman. I think there is very great objection to this, the workman generally not being allowed to design, simply because he is not educated for it, consequently you would have a great deal of trash sent in. On the contrary, while they are selected by you, they are sure to be examples of the highest order, and the study necessary to work them properly will be sure to improve the best workmen's taste, and will ultimately do a deal of good in the working of metal, and, I trust, will answer the noble end you have of improving the Art-Workman.—I am, &c., F. Holliday.

14, Nailour-street, Islington, Jan. 29, 1865.

Art Workmanship.—Sir,—This is to add a few observations to those I made at the meeting held at the Society's House on the 2nd instant. I do not think I made myself quite clear about the time allowed for the execution of the works; I think that, so far as my own business is concerned, the time allowed was ample, as it included the whole of the summer months; the past year was rather an exceptional one with us; advertisements for silver engravers were of weekly occurrence, and most had to work over-hours, so as to leave no time for the execution of so difficult a work. I have been in the habit of telling the young men whom I train to the business, that slack times are our golden opportunities for improvement—each one is then able to follow his own bent, and great advance is generally made in knowledge and skill. The chairman correctly observed that it is to the rising generation of art workmen that these competitions will be most beneficial; I will add that it is important that men of mature years should give their time up to the furtherance of so good a cause. In my own workshop every stage of the process of engraving my competitive specimen was watched with the keenest interest by the young men and apprentices I am training; and I cannot doubt that seeds have been thereby sown which in time will show their fruit in the Society's Hall. Experienced engravers, to whom I have shown the photograph selected for competition, have strongly objected to the labour necessitated by the chequered back-ground. Doubtless it requires much time and care for its proper execution, but I have found in it a great source of effect—it acts as a middle tint, giving powerful relief to the strong lights and

shadows on the arabesque; and when we have mastered the difficult task of niello filling-in, it will prove a great means of giving due effect in graver-work. I think the Council would do well to apply a higher test of our power of drawing in the future competitions among engravers; I think it would tend to bring forward our most skilful men. In this year's work we had only to make a careful tracing; and I beg leave to make the following suggestion:—That we be invited to make a reduced copy of some figure-work of a high character; for instance, the South Kensington photograph of Marc Antonio's engraved figure of Lucrece, the drawing of which on the copper is ascribed to Raffaelle himself. The figure is seven inches in height; we might be invited to reduce it to four and a half or five inches; it would be a high test of our drawing capabilities. I would further suggest that, in order to give us an opportunity of showing whether we are capable of producing something with the stamp of originality about it, we be allowed to surround the figure with an arabesque border, say an inch in width, and comprising masks and emblems appropriate to so tragic a subject; a prize might be offered for the figure alone, and an additional prize to be competed for by those who felt sufficient confidence in themselves as to make an attempt at an original composition. In the matter of advertising, I believe the best means of making the offers of the Council known in the provincial towns, will be to advertise in the local newspapers of largest circulation. In this town the *Sheffield and Rotherham Daily Independent* and the *Sheffield Daily Telegraph* are largely circulated among the workshops. I would advise the insertion of the Council's programme for the year in these papers, three times a week for two weeks. I believe that all who are interested in this town would then know of it. There is every appearance of a brisk demand for art-work in the opening year; the Council must not, therefore, feel surprised if they meet a smaller number of responses to their offers than they desire and expect; but I have not a shadow of a doubt that these competitions will grow in importance year by year. Slack times follow busy as surely as winter follows summer, and when they again come round I believe you will find the walls covered with competitive examples; men will then in effect say, "I am here, capable of executing work like this, will any one employ me?"—I remain, &c., G. McKenzie.

12, Tudor-street, Sheffield, Jan. 7, 1865.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Arts, 8. Cantor Lectures. Mr. B. Waterhouse Hawkins, "On the Reproduction of Natural Forms by Art and Manufacture." Lecture IV.
R. Geographical, 8½. Capt. Sherard Osborn, R.N., C.B., "Exploration of the North Pole."
Entomological, 7. Annual Meeting.
British Architects, 8.
Medical, 8. Dr. James Jones, "Inflammation as an Exciting Cause of Tuberculosis."

Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. T. Hawthorn, "Description of the Port and Docks of Marseilles."
Zoological, 8½.
Ethnological, 8. 1. Mr. Wallace, "On Civilisation in North Celebes." 2. Prof. Busk, F.R.S., "On Human Remains from Gibraltar."
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."

Wed. ...Society of Arts, 8. Mr. C. F. T. Young, "On the Best Means of Protecting London from the Ravages of Fire."
Geological, 8. 1. Mr. Julius Haast, "On the Excavation of Valleys by Ice." 2. Mr. James Bryce, "On the Order of Succession in the Drift-beds of Arran." 3. Mr. E. Ray Lankester, "On the Sources of the Mammalian Fauna of the Red Crag." Communicated by Prof. Huxley.
Archæological Assoc., 8½.

Thurs...Royal, 8½.
Antiquaries, 8.
Philosophical Club, 6.
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."

Fri.......Royal Inst., 8. General Sir H. Rawlinson, K.C.B., "On the Results of Cuneiform Discovery to the present time."

Sat.......R. Botanic, 3¾.
Royal Inst., 3. Prof. Marshall, F.R.S., "On the Nervous System."

Patents.

From Commissioners of Patents Journal, January 13th.

GRANTS OF PROVISIONAL PROTECTION.

Autograph stamps—3198—Hon. J. Hay.
Boots and shoes, manufacture of—3194—T. and J. Fagg.
Brushing the hair, mechanical apparatus for—3167—C. E. Bryant and S. Middleton.
Carpets, &c., manufacture of—7—J. Spencer and N. Broomhead.
Cavalry stables, connector applicable to bales used in—3211—J. P. Robinson.
Coke ovens—3214—H. Hicklin and C. Pardoe.
Coke ovens—3222—J. R. Breckon and R. Dixon.
Drying machine, centrifugal—3204—J. Rowberry.
Entertainment, construction of houses of—1—W. Muir.
Fan blowers—23—W. Ager.
Farinaceous food, article of—2684—B. R. Keith.
Fire-arms—3132—A. H. Renton.
Fire-arms, breech-loading—2912—J. Snider, jun.
Fire-arms, &c.—3196—R. A. Brooman.
Glass house pots, manufacture of—3075—E. Brooke, jun.
Governors—3169—M. Henry.
Governors—3182—J. Byrne.
Gun barrels, manufacture of—3111—P. A. Le Comte de Fontainemoreau.
Heavy bodies, apparatus for moving—3153—D. Millar.
Household fires, lighting—3180—J. G. Aram.
Hydrocarbon fluid lamps, burners for—3245—A. S. Macrae and A. Bayley.
Iron, furnaces used in the heating and melting of—3116—J. Ellis.
Jute, &c., treatment of—3191—J. Paterson.
Lamp feeders, construction of—3178—H. Edmonds.
Liquids, &c., warehousing or storing—3241—P. C. P. L. Prefontaine.
Looped fabrics, machinery for producing—3225—J. & W. Thornton.
Manual power, carriages propelled by—3259—T. Du Boulay.
Marine steam engines, anti-saline coating for—2605—L. Paviola.
Mine shafts, preventing accidents in—3208—C. H. Taylor.
Mules for spinning—21—J. Knowles and J. Banks.
Mules for spinning and doubling—3237—J. Dodd.
Nuts, manufacturing metallic—3188—G. Haseltine.
Ordnance, mounting—3077—A. Moncrieff.
Ordnance, preparing charges for, &c.—3231—D. Sutherland.
Oxygen gas, manufacture of—5—J. F. Parker and J. Tanner.
Paper board, machines for making—25—J. F. Jones.
Paper, manufacture of—15—L. D'Aubreville.
Pianos, manufacture of—3224—J. Bardies.
Pitch, treatment of—9—R. Irvine.
Portland cement, manufacture of—3221—J. Cleaver.

PATENTS SEALED.

1797. P. G. B. Westmacott.	1875. J. P. Chambeyron.
1805. J. Syme.	1876. J. P. Chambeyron.
1807. G. P. Harding.	1987. G. Haseltine.
1808. C. Whittaker & J. Cocker.	2033. E. A. Pontifex.
1809. J. Laubereau.	2092. R. Pilkington.
1811. W. H. Wilks.	2398. T. Bennett.
1817. J. Hart.	2421. H. Druce.
1821. J. Whitford.	2477. H. and F. J. Kemp.
1874. V. Wanostrocht.	2600. W. H. Harfield.

From Commissioners of Patents Journal, January 17th.

PATENTS SEALED.

1803. J. Maynes.	1861. A. Wydler.
1806. O. Phalp.	1862. L. R. Bodmer.
1812. J. Coton.	1864. W. Irwin.
1819. W. E. Gedge.	1865. J. Slater.
1824. A. Topp and J. Holt.	1866. M. Scott.
1825. J. Higgins.	1881. J. Newsome.
1827. W. E. Gedge.	1908. C. Eastwood.
1829. F. Peskett.	1979. A. Turner.
1834. G. Stevenson.	2169. A. V. Newton.
1840. P. Æ. Le Boulengé.	2841. T. E. Vickers.
1841. F. Gregory.	2927. F. Pfanhauser.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

73. M. Wigzell.	92. J. Parker and J. and B. Wells.
83. J. White.	99. J. G. Marshall.
109. C. Hill.	106. W. Gorse.
226. W. E. Newton.	113. W. Cleland.
287. W. E. Newton.	129. R. Romaine.
82. H. Charlton.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

3178. T. Spencer.	73. R. Archibald.
83. E. Wilson.	

Registered Designs.

Clasp for securing cuffs or wristbands—Jan. 11—4683—T. Thomas, Great Barrow, near Chelmsford.
Chape and buckle for saddle girths and other bands—Jan. 16—4684—David Power and Sons, Walsal.
The people's clothes wringer—Jan. 17—4685—G. Askir, 4, Wellington-street, Blackfriars-road.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, JANUARY 27, 1865. [No. 636. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Cantor Lectures.

"On the Reproduction of Natural Forms by Art and Manufacture." By B. Waterhouse Hawkins, Esq., F.G.S., F.L.S.

Mr. Hawkins will conclude his Course, on Monday Evening next, as follows:—

Jan. 30th.—Lecture V.—On Ceramic Manufactures, with the Influence of the material on the design and its successful production—modern Terra-Cotta, Della Robbia ware, Majolica, and Parian.

These Lectures are open to Members free of charge, and a Member has the privilege of introducing ONE Friend to each Lecture. A set of tickets for this purpose has been sent to every member.

Professor Ansted's Course of Six Lectures, on "The Applications of Geology to the Arts and Manufactures," will commence on Monday Evening, the 6th February.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

Feb. 1.—"On London Sewage, from the Agricultural Point of View." By J. Chalmers Morton, Esq.

Feb. 8.—"On the Claims of Authors and Inventors to Property in and Protection for Designs and Inventions first published at Industrial Exhibitions." By Thomas Webster, Esq., F.R.S.

Art-Workmanship.

The following is a list of the Prizes awarded. The judges were Richard Redgrave, Esq., R.A., M. Digby Wyatt, Esq., and John Webb, Esq.:—

1st Division.

Works Executed from Prescribed Designs.

Class 1.—Carving in Marble, Stone, or Wood.

(*a.*) *The Human Figure.*—Work executed in marble or stone, after the Boy and Dolphin cast from a chimney-piece, ascribed to *Donatello.*—Four works sent in.—1st prize of £15 to G. T. Sherborn, 59, Ponsonby-place, Millbank, S.W.; 2nd prize of £7 10s. to Alexander Kenmure, 43, Pancras-square, N.W.

(*b.*) *Ornament.*—Work executed in marble, stone, or wood after a carved chair-back in the South Kensington Museum.—One work sent in.—1st prize not awarded; 2nd prize of £5 to James Stuart, 7, Pancras-square, N.W.

(*c.*) *Ornament.*—Work executed in stone, after a *Gothic bracket* in the Architectural Museum.—Three works sent in.—1st prize of £10 to T. V. Wran, 65, Lambeth-walk, S.; 2nd prize of £5 to John Barker, 7, Draycot-street, Sloane-square, S.W.

(*d.*)—Work carved in *wood* after a design by *Holbein.*—One work sent in.—1st prize not awarded; 2nd prize of £10 to W. H. Baylis, 69, Judd-street, W.C.

(*e.*)—Work carved in wood after the *Head of a Harp* of the period of Louis XVI.—One work sent in.—1st prize not awarded; 2nd prize of £7 10s. to T. E. Mayle, 17, James-street, Camberwell-new-road, S.

(*f.*) *Ornament.*—Work carved in wood after an *Italian picture frame.*—No works sent in.

Class 2.—Repoussé Work in any Metal.

(*a.*) *The Human Figure as a bas-relief;* after *Raphael's "Three Graces."*—Four works sent in.—1st prize not awarded; 2nd prize of £5 to W. Holliday, 14, Nailour-street, Islington, N.

(*b.*) *Ornament.*—Work executed after a Flemish salver in the South Kensington Museum.—Three works sent in.—1st prize of £5 to Septimus Beresford, 29, Myddelton-street, E.C.; 2nd prize of £3 to H. R. Batchelor, 149, St. John's-street-road, E.C.

Class 3.—Hammered Work, in Iron, Brass, or Copper.

Ornament.—Work executed after a portion of the Pediment of a Gate (German work, date about 1700), in the South Kensington Museum.—Three works sent in.—1st prize of £7 10s. to T. Winstanley, 10, Arthur-street, New Oxford-street, W.; 2nd prize of £5 to J. Zobel, 139, Euston-road, N.W.; extra prize of £2 to W. Letheren, Lansdown Iron Works, Cheltenham.

Class 4.—Carving in Ivory.

(*a.*) *Human Figure in the round.*— After an *Ivory*, by *Fiamingo.*—Two works sent in.—No first prize awarded. —Two second prizes of £10 each awarded ; one to J. W. Bentley, 22, Sherwood-street, Golden-square, W. ; and one to John Richards.

(*b.*) *Ornament.*—Work executed after a pair of *Tablets.* —No works sent in.

Class 5.—Chasing in Bronze.

(*a.*) *The Human Figure.*—Executed after a reduced copy of "*Clytie.*"—One work sent in.—1st prize of £10 to T. Nichols, 4, Everilda-street, Hemingford-road, N.

(*b.*) *Ornament.*—Work executed after *Goutier*, from a cabinet in the possession of Her Majesty the Queen.—Nine works sent in.—1st prize of £10 to R. E. Barrett, 26, Harrison-street, Gray's-inn-road, W.C. ; 2nd prize of £7 10s. to H. J. Hatfield, 16, Alfred-street, Tottenham Court-road, W.C.

Class 6.—Etching and Engraving on Metal—Niello Work.

Ornament.—Work executed after arabesques by Lucas Van Leyden, 1528.—Two works sent in.—1st prize of £10 to Gilles Mackenzie, 12, Tudor-street, Sheffield. 2nd prize not awarded.

Class 7.—Enamel Painting on Copper or Gold.

(*a.*) *The Human Figure.*—After *Raphael's design of the "Three Graces,"* excuted in *grisaille.*—No works sent in.

(*b.*) *Ornament.*—Executed after a German arabesque (16th century).—No works sent in.

Class 8.—Painting on Porcelain.

(*a.*) *The Human Figure.*— After *Raphael's "Two Children,"* in the cartoon of "*Lystra.*"—Seven works sent in.—No prizes awarded.

(*b.*) *Ornament.*—Executed after arabesques by Lucas Van Leyden, 1528.—Two works sent in.—1st prize of £5 to J. B. Evans, South-street, Mount Pleasant, Fenton, Staffordshire Potteries.—No second prize awarded.

Class 9.—Decorative Painting.

(*a.*) After an *ornament*, from *Castel R. Pandino*, near Lodi, from a drawing in the South Kensington Museum.—Two works sent in.—1st prize not awarded.—2nd prize of £3 to John Henk, George-street, Stoke-upon-Trent.

(*b.*) *Ornament.*—Executed after a *picture frame*, in the South Kensington Museum.—No works sent in.

Class 10.—Inlays in Wood (Marquetry, or Buhl), Ivory or Metal.

Ornament.—Executed after a specimen in the possession of the Hon. John Ashley.—One work sent in (metal). —1st prize of £5 to E. A. Millward, 35, Little Clarendon-street, Somers-town, N.W.

Class 11.—Cameo Cutting.

(*a.*) *Human Head.*—After *Wyon's* heads of the Queen and the Prince Consort, on the Jurors' medal of 1851.—Two works sent in.—1st prize not awarded.—2nd prize of £5 to James Ronca, 156, King's-road, Chelsea, S.W.

(*b.*) *Animal.*—Work executed after *Wyon's "St. George and the Dragon,"* on the Prince Consort's medal.—One work sent in.—No prize awarded.

Class 12.—Engraving on Glass.

Ornament.—Work executed after arabesques by Lucas Van Leyden, 1528.—No works sent in.

Class 13.—Wall Mosaics.

Human Head.—After *Bertini*, of Milan.

General competition.—Three works sent in.—1st prize of £15 to Samuel Cooper, Longfield-place, Hartshill, Stoke-on-Trent. 2nd prize of £10 to G. H. Stevens, Lambeth Glass Works, Carlisle-street, S.

Female competition.—One work sent in.—1st prize not awarded. 2nd prize of £10, to Miss E. Mossop, Windmill-lane, Brentford, W.

Class 14.—Gem Engraving.

(*a.*) *Human head.*—After an original in the possession of John Webb, Esq.—Three works sent in.—No prizes awarded.

(*b.*) *Full-length figure.*—After an original in the possession of John Webb, Esq.—One work sent in.—1st prize not awarded ; 2nd prize of £5 to John Wilson, 14, Leicester-place, W.C.

Class 15.—Die Sinking.

Human head.—After the head of the Prince Consort, by *Wyon*, on the Society's medal.—Five works sent in.—1st prize not awarded ; 2nd prize of £5 to John Hatchett, 5, Gloucester-terrace, Kennington-park, S.

Class 16.—Glass Blowing.

Ornament.—After an original in the South Kensington Museum.—No works sent in.

Class 17.—Bookbinding and Leather Work.

(*a.*) *Bookbinding.*—After an Italian specimen in the South Kensington Museum.—One work sent in.—1st prize of £7 10s. to Louis Genth, 15, Broad-court, Bow-street, W.C.

(*b.*) *Leatherwork.*—Outside covering of a jewel casket. Original in the South Kensington Museum.—No works sent in.

Class 18.—Embroidery.

Ornament.—After a German example in the Green Vaults at Dresden, or an Italian Silk in the South Kensington Museum, No. 7468.—No works sent in.

2nd Division.

Works Executed without Prescribed Designs.

Wood Carving.

(*a.*) *Human figure in alto or bas-relief ; animals or natural foliage may be used as accessories.*—Twelve works sent in.—No first prize awarded.—2nd prize of £15 to Mark Rogers, 111, Tachbrook-street, S.W., for a carving, "Spring ;" a Child's Head. 3rd prize of £10 to James Griffiths, 8, Addington-place, York-road, S., for a carving, "Cain preparing his Sacrifice." Extra prize of £8 to T. W. Wallis, Louth, for a carving of a Child's Head, "Hope for the Future."

(*b.*) *Animal or still life. Fruit, flowers, or natural foliage may be used as accessories.*—Five works sent in.—2nd prize of £7 10s. to T. W. Wallis, Louth, for a carving of "Wagtail and Fly." 1st and 3rd prizes not awarded.

(*c.*) *Natural foliage, fruit, or flowers, or conventional ornament in which grotesque figures or animals may form accessories, preference being given where the work is of an applied character for ordinary decorative purposes, as representing commercial value.*—Nine works sent in.—No first or second prizes awarded.—Two third prizes of £5 each awarded ; one to George Murray, 6, Claremont-place, Henderson-row, Edinburgh, for a carving of a Frieze ; and one to W. M. Holmes, 101, Dean-street, Soho, W., for a Tripod-stand. Extra prize of £3 to George Lock, 26, Albert-street, Camden-town, N.W., for a carving of Festoons of Flowers.

An extra prize of £5 to Gerrard Robinson, 14, Duke-street, Manchester-square, W., for carvings of the human figure in the round.

Proceedings of the Society.

CANTOR LECTURES.

FOURTH LECTURE.—MONDAY, JAN. 23.

The argument which Mr. HAWKINS had endeavoured to sustain, on the three previous occasions on which he had addressed the Society, on the subject of the Reproduction of Natural Forms by Art and Manufacture, had been to show that the education of the hand, with regard to art, continues to be in excess of that of the mind. To attain to any degree of fame in the higher branches of art, the artist must possess some innate feeling, but as there were those who could write and speak good English without being historians or poets, so there were artists possessing a certain amount of good sense, which, when it had acquired good taste by education, could be of more real service to manufacturers than the highest ideal powers when not submitted to a well-regulated mind. But the artist who was intending to aid manufacturers must obtain some knowledge of the process and materials by which his works were to be multiplied. On the present occasion it was Mr. Hawkins's intention to call their attention to metal work. The various metals—iron, brass, copper, and the precious metals—were so constantly used in the every-day necessities of life, from the cottage to the palace, and in our churches and other public buildings, that there was a vast demand for the combination of art with these materials. Mr. Hawkins sketched on his black canvass several instances of defective designs in metal work, pointing out the paucity of invention, which induced our artists to become mere imitators. He censured the incessant use of reproductions of flowers in every material—wood, leather, gutta-percha, porcelain, and iron. He also showed how unfit feathers, flowers, and ribbons were to form part of the decorations of cast-iron gates; and even when water-lilies were introduced very appropriately into a design for a drinking-fountain, he remarked that had the artist exercised his thinking faculties he would not have placed these flowers at the top of a high arch formed by tree branches, in total violation of their natural position, which was floating horizontally on the surface of the water. Mr. Hawkins proved the necessity for a knowledge of the process of casting to those who design models for reproduction in metal, by demonstrating the difficulties which were often thrown in the way of the moulder by the inattention of the artist to the requirements of the process. If the designer had merely learnt to draw, and not to model, he would find great difficulty in adapting his designs so as to avoid "undercuts," which render it necessary to divide the mould, thus increasing the labour and adding to the expense without necessarily enhancing the beauty of the work. During Mr. Hawkins's lecture his observations on metal casting were illustrated by a workman, who was making a sand-mould from a group of aurochs, which Mr. Hawkins had modelled some years ago. This process the lecturer rendered intelligible by his outlines on the black canvass. On the next occasion (Monday, Jan. 30) metal will be poured into the mould, to complete the demonstration of the process of metal casting so useful to the designer.

EIGHTH ORDINARY MEETING.

Wednesday, January 25th, 1865; WILLIAM HAWES, Esq., Chairman of the Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Bonnerjee, W. C., 108, Denbigh-st., St. George's-rd., S.W.
Hill, Frederic, The General Post Office, E.C.
Peckett, George, 10, Aberdeen-park, Highbury, N.
Perkins, Houghton, 25, Mortimer-street, W.
Robinson, Noel Hooke, 6, Great Queen-street, S.W.
Rodger, Captain William, R.N., 9, Shawfield-street, King's-road, S.W.
Sancton, Philip, 28, Cumberland-ter., Regent's-pk., N.W.
Smith, Colonel John Thomas, R.E., 27, Cannon-st., E.C.
Stone, George Graham, 78, Holland-park, W.
Sudlow, John J. J., 8, Manchester-buildings, S.W.
Thompson, Thomas C., 42, Belsize-park, N.W., and Sherburn Hall, Durham.
Tomline, William, 5, Whitehall-yard, S.W.

The following candidates were balloted for and duly elected members of the Society:—

Haines, Alfred, Kensal-house, Harrow-road, W.
Knowles, S., Tottington, near Bury, Lancashire.
Mayson, J. S., Charlotte-street, Manchester.
Tremlett, Rev. Francis W., LL.D., The Parsonage Belsize-park, N.W.
Whitehead, J. B., Rawtenstall, Lancashire.

The Paper read was—

ON THE BEST ORGANIZATION FOR PROTECTING LONDON FROM THE RAVAGES OF FIRE.

By CHAS. F. T. YOUNG, Esq., C.E.

Fire, like the rest of the elements, when properly used and controlled, is an excellent servant and assistant to man; but, when it obtains the mastery, it is, as we find from past and continued experience, a most terrible and ruthless tyrant, destructive alike to life and property, and perfectly indiscriminate in its ravages. The palace and the hovel, the prince and the peasant, the old and the young, are equally open to its destructive influence; and it becomes the bounden duty of all to do their best to prevent its doing mischief, and confine its powers within those bounds in which it is found to act most beneficially for man.

Carelessness and wilfulness are the two best allies by whose influence it so frequently exceeds its bounds, and against these it is impossible always to guard; consequently we find, from the earliest ages, provision made for restitution or punishment, according to the origin of the fire, and in the case of wilfulness it was punished by death.

From a death by fire or burning we all instinctively shrink, and with reason, for a more fearful or terrific termination to one's existence cannot well be imagined; therefore, as when a fire once breaks out it is impossible to foretell the extent of its ravages, or the loss of life that may ensue, it is proper that the punishment of arson should be made most severe, and also that for culpable carelessness, the effect being the same though the motives may differ.

A large fire, especially amongst much inflammable material, is an awful and magnificent sight, and one usually as ruinous and fatal in its results as it is extensive and magnificent in appearance. In a few hours the labours of a lifetime, or even of a generation, disappear, leaving in their place a shapeless, useless mass of ruin, and the owners or dependents houseless or penniless, and frequently to commence again those labours and exertions that possibly another year or so would have rendered unnecessary.

To provide some means for counteracting these dreadful effects seems to have been a part of the business of every civilised nation from the earliest times; and there can be no reason to doubt that such means existed and were in use, in most of the celebrated cities of antiquity, such as Nineveh, Babylon, Tyre, and others; for it is difficult to believe that the engineers and mechanicians of those cities, whose talents and skill are so well known, would have omitted to provide some means of counteracting or extinguishing fires, the fearful ravages of which were well known and would be of such injury to their magnificent cities. That this was the case is rendered the more probable from our finding that Pliny the Younger

wrote to the Emperor Trajan asking permission to establish a fire brigade of 150 men, into which he proposed to admit only those of that business: and we find him stating that the town of Nicomedia was burnt, because of the laziness or indifference of the inhabitants, and from want of proper machines or apparatus for extinguishing the flames. When ancient Rome was rebuilt, every citizen was required to keep in his house "a machine for extinguishing fire;" but what those machines were we are not informed. As in those days there were buckets, mops, hooks and syringes, it is reasonable to suppose that they were the latter; for we find that the dimensions of these squirts, when employed for extinguishing fire, were generally regulated by those of the building in which they were to be used. Pliny, in speaking of fire machines, uses the term "Sipho," which by some is taken for pipes or water tubes; but in a passage from a fragment of a work of Apollodorus, the architect to the Emperor Trajan, we are told when a fire occurs in the upper part of a house and the "Sipho" is not at hand, to take leather bags and fill them with water, connecting long pipes to them; and then, by compressing the bags, the water will be thrown to certain heights; therefore it is fair to say, from this description, that whatever the "Sipho" may have been, it was evidently a fire engine; for if such a rude contrivance as that described was applicable in its stead, it must be tolerably evident that the "Sipho" was an efficient machine for the purpose.

The ancient Romans, we are told by Suetonius, maintained bands of trained fire-men called matricularii, whose duty it was to extinguish fire; and there were also firemen in all the provincial towns. Petronius mentions their cutting away with axes, and throwing water from buckets at fires. To the ancients who lived nearly 2000 years ago we are indebted for the modern manual engine, which was invented by Ctesibius, of Alexandria, an engineer of that city, who lived in the 165th Olympiad, or about 120 years B.C. His pupil, Hero, of the same city, describes one in his "Spiritalia," which had metal cylinders—metallic pistons—spindle valves, with guards to prevent their opening too far—a goose neck, formed by a kind of swivel joint—something like a union or coupling screw—the application of an air vessel—two pumps forcing the water through one pipe—and one lever to work both pumps; all these are features, some or all of which have been revived and brought forward in modern times as great improvements or inventions.

It would be tedious, would take up too much time, and be foreign to my present purpose, to give a consecutive account of the different laws, ordinances, rules and regulations, made from these times for extinguishing or controlling fires, but they will be found fully treated of in a new work on the subject shortly to be published: therefore I propose to commence with what has been done to protect London since the Great Fire of 1666. The enormous destruction of property by this tremendous conflagration seems to have convinced the Government and City authorities of the imperative necessity of some well regulated means and appliances for the controlling of fires, and Acts of Parliament and Common Council were passed to obtain them. The city was divided into four districts; each of the twelve companies and aldermen were to provide themselves with brazen syringes, leather buckets, ladders, pickaxes, shovels, &c.; and, to obtain the water required for the engines and squirts, pumps were ordered to be placed in all wells, and fire plugs in the several main pipes belonging to the New River and Thames Water Works.

In the official report or account of the Great Fire, dated Whitehall, September 8th, 1666, it is remarked that "this lamentable fire in a short time became too big to be managed by any engines," thus showing that some other apparatus besides the hand-squirts must have been in use. These hand-squirts were worked by three men, one on each side to hold and direct, and one at the piston-rod to force the water out, just the same sort of thing as was used some 1800 years before!

In 1708, the 6th year of Queen Anne, it was enacted that "each parish shall keep a large engine and a hand engine, and a leathern pipe and socket of the same size as the plug or fire-cock (of the water mains), that the socket may be put into the pipe to convey the water clear to the engine," under a penalty of ten pounds. It also provided that the first person who arrived with a parish engine to extinguish a fire was entitled to 30s. reward; the second, 20s.; and the third, 10s.; provided the engines were in good order, "with a socket or hose or leather pipe." This Act, with the usual characteristic of English Acts of Parliament, contained no provision or regulation for the payment of the expenses of working these engines at fires, nor did it impose any obligation on each parish to take the engines to a fire; therefore, if the engines and required appliances were provided by each parish, the Act would be duly complied with, and they need not be used at all, but kept locked up, if it pleased the parish authorities to do so, without in any way contravening the provisions of it—a fine example of the legislative wisdom of the Solons of the 18th century.

In 1709, the owners and keepers of "other large engines" (not parish engines) were entitled to the same reward upon arriving with them and assisting in extinguishing a fire. In the same year, an Act was passed by which it was enacted, "That every servant by whose negligence or carelessness a fire should be occasioned, should forfeit one hundred pounds, or, in default, be imprisoned and kept to hard labour during eighteen months." In the case of setting fire to a house wilfully, it was made a capital offence, punishable by death.

From this time a period of nearly one hundred years elapsed, viz., to 1808, without any really efficient system for protecting the metropolis from fire being brought forward, or anything being done, except a little "tinkering" by Acts of Parliament, in relation to parish engines, &c. In 1808, however, Sir Frederick Morton Eden, the then chairman of the Globe insurance office, attempted to form a fire-engine establishment, for the protection of life and property from loss by fire. He proposed that each office should furnish 20 firemen; that all matters relating to appointments of firemen, and the business connected with the proposed establishment, should be managed by an Engine Committee; and that each office should pay an equal contribution towards the expenses of the establishment. By the end of the year, Sir Frederick was convinced of the time not being yet come, by finding that only one office, out of all the number, namely, the Atlas, could be got to join him; consequently he gave up the attempt.

About the year 1825, a union similar to that proposed by Sir F. M. Eden 17 years before, was formed by the Sun, Union, and Royal Exchange, who placed all their engines and men under one superintendent; and some time afterwards they were joined by the Atlas and Phœnix. On the 1st January, 1833, the London Fire Engine Establishment was formed, by ten of the insurance companies uniting, with the view of reducing the separate expenses of each office, and giving mutual assistance at fires. These ten offices were the Alliance, Atlas, Globe, Imperial, London Assurance, Protector, Royal Exchange, Sun, Union, and Westminster, and thus, after the lapse of a quarter of a century, was the system proposed by Sir F. M. Eden carried into practice, chiefly through the exertions of Mr. Bell Forde, a leading director of the Sun Fire Office, and the Brigade consisted of 80 men and 19 stations. Up to this period the engines and plant of individual offices, and those belonging to parishes, and some of the large private firms, were the only means available for use in case of fire; and at the present moment there exists no public means for this purpose, we being as it seems content to rely on private enterprise for that protection which it is the bounden duty of the public, and the public only, to supply; it being a matter of vital importance to the public, individually and collectively, that such means be provided and maintained in the highest state of efficiency

The protection obtained from the existence of parish engines is of the most ineffectual character, though there are some notable exceptions, such as St. Ann's, Soho, Hackney, Islington, and a few others, for we find, from the evidence given by Sir Richard Mayne before the Select Committee of the House of Commons in 1862 on Fires in the Metropolis, that they are "mostly at churches and workhouses, under the charge of beadles or private persons, who are paid a trifling sum by the parochial authorities. At great fires they are quite inefficient, and at trifling fires they are not wanted. There are 98 parishes in London which are bound by the old law to keep two engines in each parish; if they do it, it is no doubt done in an ineffectual manner." We also learn from the same evidence, that of the engines for which engine keepers and small rents are paid, one is said to be bricked up behind a blacksmith's shop, and if a fire happened where its services were required, part of the wall of the house would have to be pulled down to get the engine out. A man is paid for looking at it occasionally; possibly with the view of seeing it does not run away of its own accord.

Sometimes a parish engine may be seen running express to a fire, at the rate of about a mile and a-half an hour, pulled and pushed by half a dozen poor old worn out fellows from the workhouse, escorted by a crowd of all the little ragamuffins of the neighbourhood, and in such a state of perfect order and efficiency, that when arrived at the fire it cannot be put to work; this has actually happened under my own notice.

Dickens gives the following capital description of the progress to, and arrival at, a fire, of a parish engine:—"We never saw a parish engine at a regular fire but once. It came up in gallant style—three miles and a-half an hour at least; there was a plentiful supply of water, and it was first upon the spot. Bang went the pumps; the people cheered; the beadle perspired profusely; but it was unfortunately discovered, just as they were going to put the fire out, that nobody understood the process by which the engine was filled with water; and that eighteen boys and one man had exhausted themselves in pumping for twenty minutes without producing the slightest effect." My friend, Mr. Wm. Baddeley, whose thorough and practical acquaintance with London fires is so well known, writing on this subject in 1838, remarked, that "scarcely a week passes in the metropolis without the rehearsal of some such absurdity; and it has been my lot to witness many scenes of this description, even more abominably ridiculous than that which has been so graphically depicted by Boz." He also, in the same letter, stated that at the great fire in which the Royal Exchange was burnt, although there were no less than 17 fire engines within a few yards, one of the smallest engines only was brought up, and that, as a matter of course, would not work.

On several occasions, quite recently, we have had other examples of a most ludicrous character, two of which will be sufficient to prove the disgraceful state of inefficiency of the present parochial system of means for extinguishing fires. A fire occurred last year in one of the suburban districts of the metropolis, to which an engine was brought out, the hose were laid out, the levers fully manned, and worked up and down in a most enthusiastic manner, but all to no good purpose, for not a drop of water was thrown on the fire from the engine. A friend of mine came past at the time, and, not understanding the reason of the fire being left perfectly uncontrolled, stopped to see the cause, and found—it will hardly be credited—that the suction hose had taken the place of the delivery, and the delivery that of the suction. It is needless to say that the fire destroyed the premises in which it had broken out. In the next case the engine had been run to a fire some distance off, and when it arrived, and they began to see about getting to work, it was found that they had come away without any hose; consequently the engine could not be used. These would be looked upon as ludicrous in the extreme were it not that they are far too serious and important facts for other than melancholy consideration, and convincing proofs of our utterly unprotected state at the present moment—a state which is a terrible disgrace alike to our authorities and ourselves—to our authorities for not having long since devised and carried out an efficient means for the purpose; and to ourselves for suffering such a state of things to exist, especially as we have the remedy in our own hands.

It is worthy of remark, that the tendency of the fires of the present time is to become of far greater extent than formerly, and to cause far heavier losses; whilst our means of controlling them are not increased in proportion. It is a fact that most of the large London fires, within a few years past, have occurred in what are termed (almost in ridicule it would seem) "fireproof" buildings, having either originated in or extended to them; and as in these so-called "fireproof" structures the most valuable goods and materials have been stored, on account of the assumed security afforded thereby, the losses have been correspondingly heavy. When once the fire has got hold of one of these buildings it is found to be a waste of power to attempt to save it; and the exertions of the firemen have been found to be better employed in preventing the fire from extending to the adjoining premises. This was particularly the case in the great fire in Gresham-street, which annihilated the "fire-proof" building in which it originated. These "fire-proof" buildings are invariably found, in case of catching fire, to "hold" the fire, and by this means render their destruction, and that of their contents, a dead certainty; and they are to all intents and purposes most efficient "blast furnaces," whenever they, or rather their contents, unfortunately become ignited. It may be noted that floor-cloth factories, the inflammable character of whose contents is well known, are required to be built of wood, it being considered far better for the entire building and contents originally ignited to be destroyed, than by making them "fireproof," and of a nature calculated to hold the fire, to run thereby the risk of burning a whole neighbourhood.

For some time past we have heard that the Government were to bring in a Bill to give them power to create and maintain a system for controlling and extinguishing fires in the metropolis, absorbing the men and plant of the present establishment of the insurance offices; but there seems no probability of this at present, nor is it on the whole desirable, seeing that they (the Government) have already quite as much, or more, on their hands than they can conveniently manage; nor is it probable that it could be done by them in that mode which is best calculated to make the required protection thoroughly complete, and of the nature required by the public. In the "Fires in the Metropolis Bill" it is proposed to begin with a tax of £65,000 per annum. The next proposition is that the protection of the metropolis from fire shall be entrusted to the Metropolitan Board of Works, who are to be empowered to purchase the existing plant of the London Fire Engine Establishment and levy such necessary rate on the ratepayers of the metropolis as may be required to meet the expenses of maintaining it; but this is a proposition I feel sure will be opposed by all the parishes of the metropolis, and the ratepayers generally, for though the insurance offices would have to contribute towards its maintenance, still it would be impossible to control the expenditure in a satisfactory manner, or to fix a point which should be the maximum the ratepayers would have to contribute. I think that this proposal also will not be the one calculated to protect the public in the manner required, and it will be agreed by most of us that we have quite enough rates already for other purposes, none of which, it may be remarked, decrease in amount, and that any further increase of them, either in amount or number, is far from desirable.

As an example of what these rates and taxes might amount to in maintaining a force of men sufficient to control the fires of the metropolis, it is estimated that it

would require a protective force of at least 500 men, in addition to the present staff (which would be only 1 in 6,000 of the population); and to keep up this staff as a paid brigade, would require us to be taxed for wages only to the extent of £37,000 per annum. This amount would of course be increased if more men were put on, and with London spreading out at its present rapid annual rate, it would not be very long before a larger sum would be required. Knowing, therefore, from present and past experience, how rapidly rates and taxes increase, it is but fair to assume that the extent and amount of a rate or a tax for the purpose of adequately protecting the metropolis from the ravages of fire, must be taken as an unknown quantity, but one nevertheless capable of unlimited extension; and for this very reason, if none other, we must one and all strenuously oppose it.

The Police Act does not and will not provide any appliances for extinguishing fire; and it is no part of a policeman's duty to make any attempt to do so, even when he sees it at the moment of the outbreak. The heavy police-rate (averaging 6d. in the £) will not admit of any men being spared for other duties than those of guardians of the peace; and even now we see frequent complaints in the public papers that their number is insufficient for this purpose. It is evident, then, that we cannot expect the required protection from the police, nor is it at all desirable that the fire-extinguishing arrangements of the metropolis should be left to them.

The time is evidently now arrived when the question of the most efficient, the cheapest, and easiest mode of thoroughly protecting the metropolis from the destructive ravages of fire, and providing a more effectual check to the tremendous conflagrations that have occurred so frequently of late, shall be set at rest; and the establishment of a truly Metropolitan Fire Brigade be accomplished; for, with the improvidence of an almost savage state of society, we have left ourselves at the mercy of the flames, and for more than a quarter of a century have shamefully neglected our duty in this respect, because the insurance companies arranged for extinguishing their own fires, by a set of men and plant; and to their inclination or otherwise we have trusted for help in extinguishing our own. It is neither just to the insurance companies, nor safe for ourselves, to trust wholly or even in part to their aid when fires occur. It should be remembered that their men and engines are designed and maintained by themselves simply for the protection of their own funds, and that there is no legal claim on them to maintain their establishment for the public benefit; but we have all grown into the false belief that we are entitled to look upon them as intended for the benefit of the public at large. No doubt, to a certain extent, they do confer this benefit; but all they can do with their present means and appliances, is far from sufficient for the daily increasing requirements; and we find that having to defray the cost of them, they stand, as is natural, on their undoubted right when they decline to augment it. What we now want is a complete and entire change of plan—one which does not inflict a compulsory maintenance of rates for the purpose, but brings into requisition that important and priceless principle—the Volunteer system—to whose energetic and chivalrous exertions we can trust with far greater certainty and satisfaction than to any paid system whatever.

It will, of course, be urged—as it was in the case of our volunteer riflemen—that they are not needed, that they cannot be made efficient, will not work as well as paid men, &c., &c.; and we have seen how all these sinister prognostications have failed. It may also be remembered that stronger reasons than these were urged against railways, and, in fact, against every improvement or "innovation," as it is termed, but, in spite of all that could be urged to the contrary, they have invariably, when once started, gone ahead, and their most persevering and strenuous opponents are found amongst their staunchest supporters.

The Volunteer riflemen, it should be remembered, provide for a danger afar off and yet to come; but the volunteer firemen are ready and willing to deal with one that is in our midst, and may meet us at any corner at any moment, and who can at this moment say that he may not, even while I am speaking, require their services?

The old proverb says, "one volunteer is worth ten pressed men." I prefer to place the word "paid" instead of "pressed." The negation of self has contributed more than anything to the success of volunteering. The sacrifice of time and money which has been made by those who have entered the ranks of our citizen-soldiers, has given a solidity, an *eclat*, and a prominency to the institution, which cannot fail to make it a most efficient weapon of defence for the country.

So far as the spirit of volunteering to carry out any really honourable and useful purpose goes, I believe it exists in the highest degree in this country, possesses a steady permanency, and a brilliant ardour; and it is only necessary to point out the direction in which it is required, to ensure its enthusiastic and perfect development. By the proper carrying out, in an efficient manner, of the system of Volunteer Fire Brigades, we shall have the proud reflection that we have around our hearths, and amongst us and our families, a brave, fraternal band, who do not work for pay, and will therefore work more effectively, heartily, and enthusiastically; and, being actuated by the true volunteer spirit, being implicitly obedient to orders, well equipped, and thoroughly acquainted with their duties, will hardly fail to render most important service in the hour of danger. By forming efficient Volunteer Fire Brigades, it should be remembered that we are not only protecting our own lives and property, and thus rendering ourselves more secure from loss, but are also assisting to protect the little all of those poorer and less fortunate neighbours who cannot afford to insure, and to whom the loss of that little all, how small soever it may be, is nearly always total ruin. It must be borne in mind that everyone is deeply interested in the quick and efficient repression of fires, and in furthering to the best of his ability any practical and efficient means for the purpose; but it is surely unreasonable to suppose that such a means cannot be easily carried into effect, provided all will lend an earnest and willing hand to do so.

It is constantly said that paid firemen will work better than volunteers, because "every man will perform his duty more energetically when he is paid." Now, I cannot, for a moment, admit that this is the case, and it will be very difficult to prove it. If paid men are best, how comes it that volunteers are always asked for when it is desired to do something very perilous or difficult—say spring a mine—storm a fort—lead a forlorn hope—rescue a shipwrecked crew—or some other hazardous undertaking? Surely, in such cases as these, where it is most important that everything should be well done, it must be admitted, from the above reasoning, that it is a mistake to allow the service to be performed by volunteers. The paid man, in all that he does, feels that he is giving an equivalent for that which he receives—and in practice will generally be found to give as much less as he can—but a very different feeling actuates the volunteer, for, as we have seen on hundreds of occasions, he throws such hateful considerations to the winds, and starts on his self-imposed task with a motive and an energy which a paid man can never know; and his unselfish exertions are certainly not less successful than those which some persons think require a pecuniary inducement to give them their assumed superiority.

Mr. Elihu Burritt, better known in this country as the "American blacksmith," now the United States' Consul at Birmingham, speaking of volunteer firemen, says, "it is one of the noblest objects aimed at that could nerve the manhood of brave men. The great battles they train themselves to fight, are midnight battles with the consuming fire; battles fought amid snow and ice in midwinter against the devouring element; charges hose

in hand to pluck the burning homes of widows and orphans from destruction; battles in which there are ample scope and play for the best bravery of the human arm. These volunteer fire companies became so popular and numerous that there was one in almost every village in New England. In my own native town, with a population of about 6,000 souls, there were three of these trained bands, besides a juvenile company for even boys of twelve years of age, who would not wait, but formed a band by themselves for the drill and exercise. It is said that the Prince of Wales has manifested considerable interest in volunteer fire companies; perhaps what he saw in America will pre-dispose him to look favourably at their introduction into England. I have noticed that it is making a little stir in France; and I read the other day of the Emperor's reviewing a fire company at Vichy. One good company paraded in Hyde-park, well drilled, in attractive uniform, and with a highly-finished engine, and going through all the exercise and evolutions adopted on such occasions, I am sure would excite lively admiration, and I have no doubt that similar companies would be formed in all the large towns in the kingdom."

Now, if it be looked on as a meritorious action and an honour in the time of war, to assist at the peril of one's life in the destruction of life and property, because it is considered desirable to do so, it must at least be esteemed equally as honourable to risk one's life and limbs in the preservation of life and property in the time of peace. Let this once be granted, and we invest the position of a volunteer fireman with that honour and merit which are its just and proper due.

In Switzerland volunteer fire brigades exist, not only in cities and small towns, but also to a great extent in villages. The most respectable citizens vie with each other in eagerness and zeal to become members of such useful associations, which, however, consist of a fixed number of men. In some places the members are divided, a portion devoting themselves exclusively to the management of the fire engines, whilst others attend to the not less important task of taking immediate possession of the house on fire, saving what property they can and protecting the remainder. The order and method with which these volunteer fire brigades are conducted are deserving of the highest commendation, and their praiseworthy exertions are thoroughly appreciated by all who understand the motives of a volunteer fireman. In order that no delay may be experienced in taking out the engine to a fire, as sometimes happens from the temporary absence of the man in charge, two or three keys are distributed to an equal number of persons living near the engine-house, so that there may always be at least one key at hand when the engines are wanted.

"In several of the cities of Germany the whole of the householders of the district are members of a society for extinguishing fire, as well organised, as thoroughly drilled, and subject to as severe regulations as our militia or volunteers. The sound of the fire alarm bell calls each man to his post; the subdivision of labour is made; the nature and duties of that labour are known; system and science, as it may be termed, pervade the whole of their movements; seldom, if ever, does the fire extend beyond the place in which it originates, and very frequently it is extinguished without much mischief to the house in which it breaks out. It is a system and an association of this kind that we require in London."

The enormous advantages to be gained by the establishment of efficient Volunteer Fire Brigades throughout the United Kingdom, can hardly be sufficiently realised, the idea being a comparatively novel one; but of its superior economy there cannot be the least doubt. Let us take London for example, with an area of 700 square miles, on which the present fire engine establishment acts, which is assumed to be protected by 32 fire engines, nineteen stations, and one hundred and fifty men, costing the insurance companies some £27,000 per annum for its only partially efficient services, and let us supplement them by a well drilled corps of volunteers, some 500 or more in number, and with some 60 stations, and the requisite plant, judiciously distributed over the area of the metropolis, thereby affording equal and instant protection alike to the insured and the uninsured, at a cost to the insurance offices of less than half of their present contributions. The advantages gained by such a change would not be long in making themselves apparent.

From the evidence given before the Select Committee, we learn that the insurance companies paid for extra labour only at the great fire in Tooley-street no less a sum than £1,100, and this to utter strangers, men who knew nothing about fires, or salvages; and it has been admitted in evidence before the committee above alluded to, that the gratuitous services of the volunteers were most valuable.

Taking the present annual expenditure of the London Fire Engine Establishment, and dividing it by the number of calls to fires received within the year, we get nearly £17 as the cost of each run. By the volunteer system all this expense might be avoided, and each district in London could be protected by its 500 volunteers without any cost at all, and as each suburb springs up the means of protecting it would be immediately found, and that too without interfering with the more populous and endangered districts.

In London something of the kind I have proposed is becoming an absolute necessity; for it will be found that at each of the large conflagrations which have occurred of late, nearly all the men and engines belonging to the Fire Engine Establishment have been congregated, thus leaving the remainder of London totally unprotected, and in a state of the greatest danger. When we reflect that the metropolis is daily enlarging in extent, its trade and population increasing, and the value of its goods and merchandise becoming hourly of greater amount, added to which is the great and increasing loss caused by each fire from these very facts, whilst the existing establishment is less able to cope with them, and cannot afford to increase its power from the constant and great expense incurred in its maintenance, which does not decrease, we can form an idea of the importance of this question.

The great fire at Tooley-street (which continued burning for a fortnight), and the great number of others, almost as destructive, which have so frequently occurred since, cannot fail to have shown to the public the total inadequacy of the means at present provided for the repression of fires in the metropolis. The *City Press*, in an article in a number for January, 1863, says:—"We want more engines, more men, more steam power, a general fund of some kind, to which all shall contribute in the ratio of their possessions, and one source of power for the administration of the whole."

The system of volunteer firemen, to supersede the abominably deficient plan of protection by parish engines, or, as is too often the case, no sort of protection at all, and also the expensive though not more efficient plan of paid brigades, is taking a strong hold on the minds of the public, who are beginning to see that by manning their own engines they obtain that efficient protection, that energetic will to combat the ravages of fire, which can only be obtained under a well-disciplined system of volunteers, a system which on all occasions proves its enormous superiority to any paid system.

The *Post Magazine and Insurance Monitor*, of the 10th December, 1864, in speaking of volunteer fire brigades, says that many of its readers "will be as much surprised as we are ourselves at the number of these valuable voluntary associations that have been formed for the protection of property and human life against the terrible casualty of fire."

I find that we have in Great Britain, at the present moment, no less than 43 Volunteer Fire Brigades, with all their engines and appliances. Of these there are, in London and the suburbs, 11 brigades, with a total of 194 members; 19 engines, one being a steamer; and the power in the number of men required to work the manual

engines represents 367 men; the total value of their plant and appliances being £8,670. The country brigades have 800 members; 70 engines, 1 steamer; representing a power of 1,200 men to work them; and the total value of their plant and appliances is estimated to be £14,000.

Of the country brigades, that of Alton was the first to employ a steam fire-engine, having obtained it at the close of last year; and the Lambeth Volunteer Brigade was the first to use it in London, having employed it nearly two years.

Volunteer Fire Brigades.

Table No. 1.—Country.

Names of Places.	Population.	Members in Brigades.	Number of Engines.	Power of ditto in men.	Value of ditto and Plant.
Alton	4,121	24	1 steam. 3 manual.	20, 20, & 12	£650
Banbridge	4,000	13	1 ,,	22	300
Birmingham...	171,951	31	2 ,,	30 & 16	350
*Broughton ...	...	...	...	...	...
Buckingham...	4,020	17	3 ,,	20, 20, & 16	300
Buxton	1,235	20	1 ,,	22	300
Carnarvon	9,883	10	1 ,,	30	300
Chester	28,000	29	3 ,,	30, 20, & 20	1,000
Cockermouth..	5,775	12	1 ,,	20	250
Coventry	38,536	67	1 ,,	22	250
Croydon (two brigades) ...	20,000	50	2 ,,	30 & 30	650
		19	1 ,,	22	250
Crystal Palace.	...	3	1 ,,	22	250
Frome............	12,916	50	2 ,,	...	400
Guildford	5,171	14	2 ,,	22 & 22	500
Hastings	11,219	60	3 ,,	20, 20, & 20	620
Holbeach	5,200	12	1 ,,	30	350
Horsham	6,056	75	2 ,,	20 & 20	350
Isleworth	6,143	...	1 ,,	24	200
Kenilworth ...	3,532	...	1 ,,	22	160
Leamington ...	15,750	28	3 ,,	30, 20, & 18	500
*Macclesfield ..	27,874	...	...	...	...
Margate	6,100	24	3 ,,	30, 20, & 2	500
Northampton..	23,500	30	3 ,,	26, 20, & 10	450
Peterborough..	8,200	12	1 ,,	22	200
Port Dynorwic.	...	12	1 ,,	20	250
*Saltaire	...	...	...	...	...
*Southampton.	...	...	...	...	...
Stowe	350	40	5 ,,	30, 20, & 18	1,000
Twickenham ..	6,254	6	2 ,,	...	250
Uxbridge	5,500	13	2 ,,	22 & 16	400
Wrexham	15,500	23	2 ,,	30 & 20	300

* No official return.

Table No. 2.—Town.

When established.	Name.	Number of Members.	Number of Engines.	Power of ditto in men.	Value of ditto and Fire Plant.
1841	Burnett's	10	2 manual.	24 & 16	£1,000
1844	Price's	20	3 ,,	20, 20, & 18	2,000
1849	Beaufoy's	7	2 ,,	24 & 14	500
1851	Lambeth	8	3 ,, 1 steam.	40, 40, & 28	3,000
1857	True Blue, Millwall	14	2 manual.	45 & 10	450
1858	Notting-hill	10	1 ,,	24	350
1862	Kentish & Camden-town	4	1 ,,	20	300
1863	Surrey	60	1 ,,	...	300
1863	Kilburn	6	1 ,,	...	300
1863	Prince of Wales, Hatcham	5	1 ,,	...	270
1864	Holloway	50	1 ,,	24	200
	11	194	18 manual. 1 steam.	367	8,670

Abstract of Volunteer Fire Brigades.

Country.

Number of Brigades, 31.
Number of Members, 800.
Number of Engines—Manuals, 70; Steam, 1.
Power of Engines, 1,200 men.
Value of Fire Plant, £14,000.

The Metropolis.

Number of Brigades, 11.
Number of Members, 194,
Number of Engines—Manuals, 18; Steam, 1.
Power of Engines, 367 men.
Value of Fire Plant, £8,670.

Totals

Brigades, 42.
Members, 994.
Engines—88 manuals; 2 steamers.
Power, 1,567 men.
Value, £22,670.

In contrast to London, with its population of over 3,000,000; an area of nearly 700 square miles to protect; its paid fire establishment of 150 men; some 32 engines; and 19 stations; and a property of the rateable value of over £900,000,000, let us place the city of Paris, with its population of 1,696,156, where we find that they have a force of 1,270 men, 130 stations, and 180 engines and fittings; all the men are soldiers, and, as is usual in that country, everything is done on the military plan. For the volunteer system, it will be sufficient to take the city of New York—not including Brooklyn and Jersey City, both having their own fire companies—where the means for controlling fire consists of Volunteer Engine, Hose, and Hook and Ladder Companies. The population of New York City is about 1,000,000, and we find that they have 55 engine companies and stations, 27 steam fire engines and appliances, 40 manual engines and appliances, 62 hose companies, with their appliances; and 19 hook and ladder companies. The men in each engine company vary in number, some companies having as low as 18 and others as high as 50.—Total firemen, 2,393. The hose companies, of which there are 62, have from 18 to 25 men in each company.—Total hose men, 1578. The hook and ladder companies, of which there are 19, have from 17 to 40 men in a company.—Total hook and ladder men, 640, giving a grand total of men engaged in controlling and extinguishing fire in New York City alone, of 4,611 men. Attached to the engine companies are 32 hose tenders and 17 fuel tenders, all on wheels, and the hose companies have 53 hose carriages and 42 hose tenders; whilst the aggregate length of hose for the engines is no less than 15 miles 103 yards, or enough to reach from the Royal Exchange to Dartford in Kent. These particulars are derived from the report for 1863, of John Decker, Esq., Chief Engineer to the Fire Department of New York, and form an astounding contrast to the state of things at present existing in London. The particulars of the Sapeurs-Pompiers of Paris have been obligingly forwarded, at my request, by Mons. J. Lebélin de Dionne, "major-ingénieur" of that corps. Being a Government establishment they do not publish a report for circulation, but the abstract of the corps, and the fires of the past year, have been copied out of the records.

Once introduce the system of Volunteer firemen, under efficient and judicious management, carefully selecting as members only those physically qualified, and training them properly with an efficient system; and there cannot be the slightest reason to doubt their becoming as important a body as our volunteer rifles, whilst, from being actuated by a very different spirit to that which exists amongst paid brigades, they will do their work in a smarter and more efficient manner, with far less damage by water, and an increasing desire to do better on every occasion when their services may be called into requisition. It cannot fail to prove most advantageous for Government, the insurance offices, and the public, to support and encourage the volunteer system, which in Germany, Switzerland, America, Australia, and elsewhere is considered far superior to any paid system, and is found to give most excellent results, for by it any number of firemen can be obtained at a cost not depending on their number but simply on the rent of the number of stations established, and the expense of maintaining the engines and plant at these stations.

We have seen that Government admits the necessity of more extended and efficient means for controlling the fires of the metropolis (of which a most convincing proof was afforded by the celebrated conflagration at Tooley-street), by their proposal for a Bill for this purpose, but which

seems just as far from becoming a fact, as when first talked about.

By establishing volunteer fire brigades in London, and also in all towns in the United Kingdom, with proper plant and appliances, and zealously contributing, according to our means and time, towards their establishment and maintenance, we remove the great difficulty out of the way of the government, namely, that existing between the government and the fire insurance companies, contributing to the London fire engine establishments, as was stated by Sir George Grey at the close of the late session, and given by him as a reason why the government bill was not brought forward. It seems to me that the Government might give a sum of money to be applied to the purchase of steam fire engines and appliances, and a certain annual grant for their maintenance, the rent of the stations, and other expenses, in return for which they would be worked and kept in order by volunteers who would find their own uniforms, and have a section constantly on duty, night and day, at all stations, so as to be ready to run out to a fire the moment a call is received. It cannot, I should think, be urged for a moment that such money would be badly applied, or that government ought not to grant funds for this purpose. The same plan might be adopted in regard to the engines and plant, as is followed when cannon, rifles, &c., are served out to the volunteers, but they should be commanded by their own officers, who should be paid out of the funds of the corps, and devote their whole time to the business; and except that the property of the engines and appliances would be vested in the Government, the whole should be, and be strictly maintained as, a volunteer undertaking in all respects.

If we take the rapid progress made by the volunteers in their drill and exercise as a criterion of what can be done by them when they take a thing in hand, we have every reason to believe that we should soon have a large number of most efficient firemen; for after all, the controlling and extinguishing of fires is a far more common sense proceeding than it is generally believed to be; and if it is possible to make ten skilled firemen, then it is equally possible to make one hundred or one thousand, especially where one has the common sense and intelligence invariably found in volunteers to deal with, and let Government give a grant to supply and maintain the stations and plant, and we will soon show them what can be done in the way of making a truly Metropolitan Fire Brigade.

As to the success of such an undertaking, let us take the Royal Society for the Protection of Life from Fire—and a more invaluable society scarcely exists—which we find is entirely supported by voluntary contributions (of more than £10,000 per annum), and the men who attend the escapes are actuated by the volunteer spirit, or they could scarcely perform the meritorious actions we so constantly hear of their doing, did they only work for their pay. If such a society as this, whose importance and advantages we all of us freely admit, can be supported by voluntary contributions, we surely cannot for a moment say that such an important and valuable institution as the Volunteer Fire Brigades cannot be equally supported.

I appeal to all, ladies and gentlemen, small and great, for a hearty and willing support, in return for which they will be amply protected from the dangers of fire by the Volunteer Fire Brigades, and also have the satisfaction of knowing that they have thereby assisted in enabling protection to be brought near to others, who otherwise might never obtain it.

We are one and all equally interested in carrying out this institution, as we shall otherwise have but one course open, namely, to pay heavy rates for the protection of endangered property owned by commercial men; but by supporting the Volunteers, it is not too much to say that under good and efficient management, and with a proper system to work on, her Majesty's Government would look with a favourable eye on them, and encourage them as they did the Volunteer Riflemen.

There are two old proverbs, which apply with peculiar force and aptitude to the question of the proper and efficient mode of protecting London from the ravages of fire. The first is, "If a thing is to be done well, do it yourself;" and the second is, "What is everybody's business is nobody's business."

As an exemplification of how well a thing can be done when we do it ourselves, look at our volunteer riflemen, and the manner in which they have sprung up, learned their duties, and become a most important and efficient safeguard to the honour and power of the nation; and this, too, in spite of every prognostication to the contrary.

Let us, I say, have another example—in our volunteer firemen—of the truth of this proverb. Let us say we *will*, and assist to the best of our ability, and by our purse, our influence, and our time, those who are willing to take the labour and trouble of starting the movement, and putting it into shape, and the rapidity and certainty with which the system will be established cannot fail to be surprising and gratifying to all who have put their shoulders to the wheel.

The truth of the next proverb is most amply proved by the fact, that up to the present time we find no one has taken the subject up in the manner which its importance demands; nor has anything been done, except in isolated cases, to extend the means of controlling the London fires. It is evident from this that "everybody" is "nobody;" it remains, therefore, for us to eliminate "nobody" from the mass, in order to change this state of things; and if we leave "nobody" out of the calculation, and "everybody" will help "somebody," I shall have pleasure in taking his duties upon me, feeling sure that "nobody" will object to "everybody" doing his best to carry out the movement, and aid it to the best of their ability, and in concluding the paper I have just had the honour of reading, I will remind you of the appropriate words of the immortal Nelson, that "England expects that every man will do his duty."

DISCUSSION.

Mr. Webber, whilst admitting the necessity of some additional means for the suppression of fires, could not concur in the suggestions offered in the paper just read. Some years since he visited America, and one night, in New York, he was awoke by the loud ringing of a large bell. On inquiring the cause of the disturbance, he was informed that it arose from one of the public fire establishments. With regard to the volunteer system, he thought, if a thing was worth having at all it was worth paying for. He had not been in New York more than ten days, when a very disastrous and rapid fire broke out in the Broadway; and although it did not last more than about an hour, no fewer than fourteen people lost their lives at it, all the sufferers being members of the Volunteer Fire Brigade; and it was stated in one of the newspapers that the larger number of these volunteers were not present at the fire for the purpose of suppressing it, but only for the purpose of plunder. Another instance was mentioned of a disastrous fire that took place during a banquet, and which was said to have been occasioned wilfully, in order to give the volunteer firemen assembled at the banquet an opportunity of displaying their valour and skill. He did not for a moment suppose that anything of the kind would ever occur in this country, but he was merely stating what he had experienced in America; although at the same time he thought some almost equally objectionable results would arise here from relying entirely upon the volunteer principle in the suppression of fires. When that principle obtained in this country with regard to the police—for at one time every tradesman was a constable—they had nothing like so efficient a body of police as they had under the existing paid system. His

own opinion was that fire brigades, to be effective, must be paid for the services they rendered.

Mr. C. F. Dennet felt called upon by the remarks just made to speak out for his own country. He was a native of Boston, U.S., and he had been a volunteer fireman there; and as a member of that society for many years, he was glad of this oportunity of giving his testimony in favour of the principle advocated by Mr. Young. With respect to the slumbers of the last speaker having been broken by the ringing of a bell in the night, he would say it was a good thing that in America, where the houses were somewhat slightly built, that a bell should be rung in the streets as an alarm of fire. By the improved system of organization that now prevailed in Boston and other American cities, the call to a fire was made by telegraph to the various stations, and the engines were started off with their attendants in the shortest possible time. In all the large towns, hydrants were placed at suitable distances through the leading thoroughfares; and in the smaller towns there were reservoirs containing many thousand gallons of water ready for use in case of fire, and the suction hose of the engine had merely to be placed in the reservoir to be brought into immediate action. Each volunteer brigade was under the command of a superintendent, and the whole was under the control of the municipal authorities. The superior officers of the brigades were chosen by the corps themselves from amongst the most efficient members, and every night there were hundreds of men in every town ready to do duty, in case of fire, at a moment's warning. The engines and equipments were the property of the town, but they were committed to the keeping of the volunteer brigade, amongst whom a friendly rivalry existed in the decorations of their respective engines and apparatus. Some of the brigades took a pardonable pride in those decorations; and in some cases the ornaments on the engine were of a costly character. In one instance the pipe which discharged the water was of solid silver. At least once a month the brigade was assembled for the inspection of the engines and entire apparatus, as well as for practice; and connected with the corps were associations both of a literary and benevolent character. The necessity for the extension of this system in London was shown by the scanty organisation that at present existed. Mr. Young had shown them on the map how few volunteer fire brigades had been established, and how ill-provided were many parts distant from the centre of the regular brigade. With respect to his own locality, the further side of Hyde-park, such protection as existed in that quarter was due to Mr. Dunsford, who had raised a volunteer brigade at Notting-hill. Within the last few years property to the amount of a million and a-half had been put up in that neighbourhood, and some of the buildings were erected with such slight materials that if a fire occurred at the bottom of the house it was almost certain to go right through the building in a very short time. He was a strong advocate for the volunteer system, but whether it could be carried out efficiently in this metropolis was a question for discussion. He thought the subject was of sufficient importance to warrant the appointment of a commission to visit America and other parts of the world in order to see their systems, and whether anything of value could be derived from them applicable to the case of the metropolis. As an Anglo-American, he had often been struck with the total insufficiency of the fire establishment in London, and it behoved them to adopt a more efficient mode than at present existed for protecting themselves and their property from the dangers of fire.

Dr. Bachhoffner thought there could be but one opinion as to the extremely inefficient state of the fire departments of the metropolis, but whether the volunteer system would meet the difficulty he was not prepared to say. With respect to the observations of Mr. Webber, he would only say that, though he was not prepared to gainsay his statements, he thought it was wrong to condemn the system as a whole because there were some unworthy members in those brigades; he was, however, quite sure that such cases as had been mentioned would never occur in this country. With reference to government interference in this matter, the paper led them to believe that that idea had been abandoned; but he thought that was a mistake, and that the approaching session of Parliament would not close without a bill being introduced by the Government investing in the Metropolitan Board of Works the entire control of the fire establishments of London. Ably as the existing fire brigade was conducted, he thought the system was extremely unsatisfactory. Some, only, of the insurance offices contributed towards the maintenance of the regular fire brigade; moreover, the late Mr. Braidwood stated, in his evidence, that if a fire broke out at the British Museum, although it was known that building was uninsured, the brigade would attend that fire; but if another fire broke out at the same time in an insured building, they would leave the British Museum, and direct their efforts to the suppression of that fire. He had no doubt, if the project which was at one time entertained, of the amalgamation of the city and metropolitan police forces had been carried out, that measure would have been followed by the handing over of the fire department to the police, but there was difficulty in the way of doing that so long as two independent bodies of police existed. It was estimated that the cost of an efficient brigade would be £60,000 or £70,000 per annum, but from data in his possession he believed it would be nearer £160,000, of which amount it was estimated the parish of Marylebone would contribute about one-twelfth, which naturally induced the parishioners to set their faces against such a measure, particularly as there were in that parish two very efficient fire engines. He thought there was something radically wrong in the present system of attempting to extinguish fires; the volume of water thrown on was not sufficiently large. Attention should therefore be directed to the furnishing of some means by which a larger amount of water could be thrown into a burning building. With regard to the volunteer brigade movement, he wished it every success.

Mr. Clarkson considered that greater attention should be paid to the prevention of fires, by having properly-constructed buildings, and also the providing of means whereby a fire could be acted upon immediately it was discovered. When a fire took place in Paris there was seldom more than a room burnt out. Owing to the careless manner in which lights were used in large warehouses it was not surprising that fires were of frequent occurrence; and he considered that the great preventive of extensive conflagrations was not in the number and efficiency of the fire brigades, but in the ready means of attacking a fire within the buildings in which it occurred.

Mr. Payne would be the last person to find fault with the London Fire Brigade, but the fact was they were totally inadequate in number and appliances to the work which was assigned to them. Moreover, the report of the surgeon of the brigade proved that a large amount of sickness existed amongst the men, caused by the overwork which they had to perform. The great point to be considered was the means by which a more adequate system could be established, and in whose hands the control of that department should be placed. If under the Board of Works, the taxation would be specially heavy; if under the police, their present duties would be neglected. With these considerations he thought the only quarter to which they could look for a remedy was the volunteer system. He trusted the time was not far distant when not only the metropolis, but every town in the kingdom, would have volunteer fire brigades.

Mr. Walter Newall thought nothing should be said in disparagement of the existing fire brigade of the metropolis. The late Mr. Braidwood and Capt. Shaw had shown what could be done with the very limited means at their command. Taking the extent of London as

13 miles long and 9 miles wide, that gave an area of only 117 square miles, instead of 700 as stated in the paper, over which the operations of the Fire Brigade extended. The insurance offices having shown a desire to relieve themselves of the burden of maintaining this brigade, the proposition might, perhaps, take the shape that government should contribute one-third of the cost; the ratepayers one-third; and the insurance offices one-third. A rate of a penny in the pound extended over the metropolis would produce upwards of £60,000. Having been for a long time connected with the administration of the building acts, he had arrived at the conclusion that greater attention should be paid to the construction of houses, particularly as regarded party walls. Great security also resulted from maintaining a constant pressure of water in the street mains, so that a jet of water 60 feet high could be directed upon a fire at the moment of its discovery, and before the engines arrived at the spot.

Mr. W. H. DALTON, as a member of the Board of Works, begged to say a few words on behalf of that body. He would state, in the first instance, that they had done nothing whatever to seek the control of the fire brigade. The Government had asked them whether they would undertake that duty, and, as a municipal body, they felt they ought not to refuse it. For his own part, he could say he had no desire to share in that additional responsibility; but if the Government and Parliament thought it should be undertaken by them, they could not do otherwise than accept it. It happened that only a certain number of the insurance offices contributed towards the maintenance of the fire brigade, while others refused to do so. Those who did contribute felt it a burden upon them, and were not disposed to continue their contributions. When this subject was brought before the Board of Works, the opinion was generally expressed by the members that, inasmuch as the insurance offices made large profits out of their business, they ought to contribute a share to the cost; and that Government, having large public buildings, should also largely contribute. With reference to the Association for the Protection of Life from Fire, he would say, although the funds were raised by voluntary subscriptions, the men who conducted the fire-escapes were not volunteers, but were regularly paid for their services, and in the event of the control of the Fire Brigade being placed in the hands of the Board of Works the association he had alluded to had requested them to undertake the control of that business also. As far as the volunteer brigade system had gone, it had been very efficient, but the brigades had been to a great extent instituted by men of large means, who had valuable properties of their own to protect. For his own part, however, if the work could be done efficiently by volunteers he would rather see it in their hands than in those of the Board of Works.

Mr. A. STEWART HARRISON said having been in New York, Boston, Chicago, and New Orleans, he could state with regard to volunteer fire brigades that whereas in Boston they were drawn from what was termed the respectable class, in New Orleans and Chicago they were drawn from the lowest classes of the labouring population. The results were such as had been alluded to by Mr. Webber, for at a fire in Chicago he had himself seen men engaged in rifling chests of preserved ginger instead of assisting to put out the fire. In this country, however, it might be assumed that the volunteer fire brigades would be drawn from the respectable classes of the community, who would render as efficient services as he had seen rendered by brigades of that character in New York and Boston. He agreed with a previous speaker, that the great point was to have means at hand of attacking a fire at the moment it was discovered, as a quarter of an hour after the outbreak tons of water would be of little use in extinguishing it. It was a fallacy to say that insurance covered the losses by fire. They were simply spread over the shoulders of the many, but there was the actual destruction of so much property, which tended to enhance prices, so that the loss fell upon the public generally, and heaviest on the poorer classes of the community.

Mr. T. JONES remarked that it was evidently intended, from the course of legislation on this subject, that there should be a volunteer fire brigade in every parish, because it was enacted that in every parish a fire-engine and ladders should be provided, which implied that there should be persons to work them, but it was no part of the law that they should be so small as to be comparatively useless. He thought it would be quite competent for parishes to organise a proper fire establishment within each paving district, and these, with volunteers in addition, would form the *nucleus* of efficient brigades throughout the metropolis and provincial towns.

Mr. S. TEULON said it was impossible to discuss the question of protection from fire in a city like London without feeling it was one of the most important subjects that could occupy their attention. It had been stated that unless water was applied at a very early stage of a fire it was very little use applying it at all, and, therefore, it occurred to him that the readiest mode of obtaining a supply of water to be directed upon a fire would be from high pressure in the street mains, with a hydrant placed at the bottom of each lamp-post. Objections had been made to employing the services of the police in this work. He would have them trained to the use of the hose, so that a fire might be attacked at once from the hydrants; but when the trained firemen arrived they should give way to them, and simply take the duty of keeping off the crowd. With reference to the volunteer system in this country, there was no doubt that, as regarded the rifle corps, it had been a great success, but the secret of that success consisted in the government having placed the highest officers in the regular army at the head of that force; so in the case of volunteer firemen, there must be an organized authority to which all parties must bow. They read in the history of the Great Fire of London, that the King deemed it his duty, as the chief authority of the kingdom, to attend personally and do what he could to mitigate the evils of that great conflagration. The custom prevailed very generally throughout the continent for the chief authorities of a town to give their attendance at fires. It was especially the case in Sweden. He (Mr. Teulon) was present at the fire which destroyed nearly one-third of the City of Gottenburg, where the exertions to subdue the flames were encouraged by the presence of the leading authorities of the place. It was the case also in Switzerland. In Sweden, it was customary for alarms of fire to be given by a watchman, stationed on a steeple or other high building, blowing a loud blast from a trumpet, by which the inhabitants were summoned to give their aid.

Mr. COX (of the Holloway Volunteer Brigade) said, having been for many years a volunteer fireman, both in Australia and in this country, he was of opinion, judging from his own experience, that the brigades required no other head than that which was universally recognised in the captain of the brigade, in whose judgment and experience the men had confidence. He could bear his personal testimony to the excellent working of the volunteer brigade system in Australia. His experience was that water would not always stop a fire, and that in many cases the most effectual check would be given by pulling down buildings in advance of the direction in which the flames tended. In such operations the services of the "hook and ladder" corps were very prominent, as he had himself seen in a great fire at Ballarat. He expressed himself highly favourable to hydrants in the streets, a system that was carried out in Melbourne through all the principal thoroughfares, at distances of 200 yards. He had the highest opinion of the value of the volunteer fire brigade system.

Mr. ROBERTS (True Blue, Millwall Brigade), as an old volunteer, would say a few words on this subject. With

regard to the strictly self-supporting system advocated by Mr. Young, that gentleman forgot that the supplying of their uniform at their own cost, with other expenses, involved considerable sacrifice on the part of the working men who formed the majority of the brigades; and, speaking with some experience, he was afraid, after a few years, the brigades would not find the subscriptions come in so readily as they did at first. With respect to the brigade of which he was the head, he could state that they had not received a penny from anyone for their services. In reply to what had fallen from Mr. Webber, he would say, better the slumbers of a whole town should be disturbed by the ringing of bells than that one life should be lost by fire. As to the method of attacking a fire, he was old enough in the service not to study show in such matters. It might be a tempting opportunity for a new brigade to show how high their engine would throw the water. His rule, however, was to "fire low," and attack the fire from the bottom. With regard to the best means of protecting buildings from fire, he confessed he had very little faith in the experiments that had been made with gases and salts as fire-annihilators. If they had those matters at hand the moment a fire broke forth they might put it out, but when fire had got hold, such appliances were of little or no use. As to the police having to do with fires he strongly objected to it, and the most essential service they could render was in keeping back the crowd. The chief difficulty on arriving at a fire was to get the engines at work, and on some occasions he had been obliged to clear the way by knocking people down. He agreed with the opinions expressed that the brigades should have some recognised head. He should be glad to see the volunteer brigade system extended throughout the country, and he hoped before long to see an Act of Parliament making it compulsory upon all parishes where a brigade was established, to provide sufficient engines and apparatus. He was sure there would be no lack of men to work them.

Mr. G. F. Wilson, F.R.S., said, having had opportunities of witnessing the working of the brigade which stood second on Mr. Young's list, established in 1844, he was bound to say, moving as this brigade did within a rather limited area, it had experienced no difficulties whatever, either with the London Fire Brigade or the police, and on occasions when they had co-operated with the former, they spoke in the highest terms of the assistance they received from them. Therefore he was disposed to think that, with harmonious action between the volunteers and the regular brigade, a most valuable aid would be afforded to their present means of combating fires in the metropolis.

After a few words from Mr. Wentworth Scott,

The Chairman said, before calling on the meeting to pass a vote of thanks to Mr. Young for the paper with which he had favoured them, he would remark that they ought, before they decided as to what was the best course to pursue, to think of how gradually the present system had grown up, until it had arrived at a point where it appeared to have become necessary that there should be some general organisation for controlling the ravages of fire. Originally each parish was bound to provide engine-power, and the voluntary services of people were looked to to work that power, and it might be said that the new system advocated by Mr. Young was only an extension of this principle. From the vast amount of property accumulated, and the great increase of buildings, the existing system had become inadequate, and he hoped, if a return to the voluntary principle was made, this would be done in such a manner as to be most useful to the public. Some years since the parishes having been found wanting, both as to mechanical power and volunteer force, there arose the interference of the insurance companies; and undoubtedly, if they were to have an unauthorised body, without public responsibility, they could not organize a force which had so much inducement to do its duty as one employed by the offices who would have to pay the damage done by the fire. To them it was a duty undoubtedly. Generally speaking, they performed it efficiently, but they found they were now in this position, that so vast was the extension of property, and so large an amount of it was not insured, that when two or more fires occurred at the same time, it was doubtful whether the uninsured would not be neglected for the sake of the insured property. They then came to two proposals, which might be considered together. The first was to place the control of this matter in the hands of the Government, and the second was to entrust it entirely to a volunteer body. They must, he thought, feel a strong objection to giving this power to the Government. He was one of those who thought the inhabitants of a municipality did what they required better for themselves than it could be done by the Government. But there was an important institution recently sprung up, the Metropolitan Board of Works, which, notwithstanding the disparaging remarks that were often made, was discharging its duties with great ability, and to whom it was proposed to entrust the management of these affairs. The question was, would that be more efficient than the volunteer system? The merits and demerits of that system had been thoroughly stated by the veteran volunteer from Millwall. He had said the volunteer brigade, while it was a novelty, was well supported, but now he found that support begin to flag. Some pecuniary aid appeared to be called for, and some authorised head under whose guidance the whole should work. Placing the volunteer fire brigade in comparison with the military volunteers, they both began much in the same way. The rifle movement was, in the first instance, carried on solely at the expense of those who volunteered; but it would not have remained as efficient as it is now if the Government had not interfered—first to place it under well-advised arrangements, and then to afford it such an amount of pecuniary assistance as enabled it to meet the difficulties which now appeared to arise in this other system. To a great many the cost of uniform would, no doubt, be very agreeable expenditure, but it might be different with many others whose services would be most valuable, and who might, from pecuniary considerations, be prevented from joining the corps. Looking at the manifest deficiency of the present system, he confessed he thought that a volunteer brigade, with a proper head (such as Captain Shaw, with whom should rest the appointment of subordinate officers), combined with a limited amount of pecuniary aid from the Government, would render very effectual service. He thought, however, that it was a mistake to suppose that the present fire brigade ever measured their work by the amount of their pay, or that any consideration of remuneration affected the willing discharge of the duties imposed upon them. They must all feel that the object was to improve an important institution of the country which had been neglected, and which he hoped the paper and discussion of that evening would tend to put before the public in a more satisfactory position than it had hitherto held. He was sure they would unite in a cordial vote of thanks to Mr. Young for having so ably introduced the subject to their notice.

The vote of thanks having been passed,

Mr. Young acknowledged the kind reception that had been accorded to his paper, and in reply upon the discussion, said he regretted that the remarks had wandered very much from the subject he had desired to introduce, viz., the difference between volunteer and paid brigades. The first speaker had spoken disparagingly of the "hook and ladder corps," but probably that gentleman was not aware that in Paris they used nothing but hooks and ladders, as was shown in a work published under the sanction of the Minister of War, entitled, "The Fireman's Manual." Dr. Bachhoffner had stated that only a certain number of insurance offices contributed to the brigade, but there were thirty who did so at the present time. He fully confirmed the statement of that gentleman as to the effi-

ciency of the fire arrangements in the parish of Marylebone. In reply to Mr. Newall, as to the area over which the London Brigade extended, he would state that they did not confine themselves to the metropolis, but they set themselves out to work over 700 square miles within and around London, even as far as Windsor, Dover, and Gravesend. With regard to fire-proof buildings, he denied that such a thing existed in practice, as was shown by the great fire in Gresham-street. Mr. Dalton stated that the Board of Works did not wish to have the control of the fire establishment; he was very glad to hear it, and hoped the unwished-for duty would never be thrust upon that body. Mr. Teulon approved of the interference of the police at fires. Their instructions were to hold the door and keep people out of the house, for which services they were paid a sovereign. He (Mr. Young) agreed that the volunteers should be organised under one head: he also concurred with the remarks of Mr. Roberts with respect to the cost of uniforms. With regard to the statement that there were fewer fires in Paris than in London, the last report showed that last year there were 1,899 fires in Paris, and only 1,624 in London. The serious fires in Paris during that period, however, amounted to only 570, and there were only 20 cases of total loss. Out of the 1,899 cases of fire about 1,300 were mere chimneys on fire. Of the fires in London 14 per cent. had been total losses. Without disparaging the services of the paid brigade, he preferred the volunteer system, for if a man put his soul into the work he would work better than one under compulsion.

Mr. STEWART HARRISON exhibited an arrangement for extinguishing fire in buildings at its commencement. It consisted of a reservoir and pipes, with valves at intervals throughout the building, so arranged that the valves are kept tight by plugs of fusible metal, and consequently, as soon as the temperature in any room reaches 212°, the plug is melted and the valve is opened, allowing of the escape of water. At the same time an electric circuit is completed, and alarum bells rung.

Proceedings of Institutions.

SOUTH AUSTRALIAN INSTITUTE.—The annual report for 1863-64, presented at the meeting held on October 11, 1864, states that a steady progress has been made in most of its important branches. The new Institute Act, which was referred to and its provisions explained at some length in the last report, was passed during the last session of Parliament. A meeting of the subscribers to the Library was held, as directed by the new Act, when, in December, 1863, J. P. Boucaut, Esq., was chosen to fill the office of Governor. Four quarterly soirées have taken place—the first in December, 1863, when the Rev. J. Maughan delivered a very interesting lecture on "Socrates, and the character of Athens in his time;" the second in March, 1864, when the Rev. Mr. Ibbetson lectured on "Natural Magic," with some curious illustrative experiments. The Lancashire Bellringers, at that time in the colony, were engaged for this soirée, and proved a great attraction. The third soirée was held on June 21, when the Lord Bishop of Adelaide presided, and the Hon. G. C. Hawker, M.P., who had shortly before returned from New Zealand, gave an account of his visit to that colony, and more especially to that part of it which is unfortunately the seat of war. The members of the Deutsche Liedertafel gave their valuable assistance in the musical part of this soirée. The last soirée took place on September 6, when His Excellency the Governor-in-Chief presided, and the Rev. Canon Russell delivered a very interesting and humorous dissertation on "Scottish Humour." The Christy Minstrels were engaged on this occasion. The following lectures have been delived since the last annual meeting, viz.:—"Oliver Cromwell," Rev. W. Harcus; "Coleridge," Rev. Canon Russell; "Mining in Cornwall," J. L. Young, Esq.; "Dr. Johnson," Rev. W. Harcus; "Geneva and Chamouni" (continuation of former lecture), Rev. F. W. Cox; "The Present Conflict in America," His Honour the Chief Justice; "Earth's Buried Cities—Herculaneum and Pompeii," Rev. J. Gardner; "Slavery—Ancient and Modern," the Lord Bishop of Adelaide; "The Circulation of the Blood," Dr. C. Clark; "The Marvels of the Solar Spectrum," Rev. J. Maughan; "Shakespeare's Jesters," J. H. Clark, Esq.; "The Solar Spectrum and its Teachings," Rev. J. Maughan; "The Progress of Music," H. F. Price, Esq. (with vocal illustrations by the Upper Hullah Class); "The Wonderful Properties of Matter" (illustrated by experiments), Rev. J. Maughan. As the last lecture of the spring series for 1863 would have fallen on Christmas Eve, it was thought that an evening of select readings might be more acceptable at that season than a lecture. This idea the kind assistance of several gentlemen enabled the Board to carry out very successfully, the Rev. J. Jefferis delivering a short introductory address on the occasion. A similar arrangement is proposed for the present year. The Institute Hullah Classes, under the direction of Mr. H. F. Price, have made satisfactory progress since the date of the last report. It is hoped that out of these classes, which are well attended, a permanent Choral Society in Adelaide will spring. Mr. Greffrath having left the colony at the end of 1863, the Board appointed Mr. Nootnagel as his successor in the mastership of the German Class, which, however, is not large. The French Class, which had for a considerable time only contained two or three pupils, has finally become extinct. The Board cannot but regret the indifference which appears to exist in reference to these two classes. The Drawing Classes are specially referred to in the report of the proceedings of the South Australian Society of Arts. The Board will therefore content themselves with expressing their satisfaction with the general tone of the instructor's report, although they could wish to see these classes also more generally supported. Four newly-formed country Institutes have been affiliated during the past year, viz.:—Mount Gambier, Moont, Mount Torrens, and Stockport; and two have suspended operations, viz.:—Port Elliot and Yankalilla. The former of these, however, is likely to be re-established before long. Efforts are being made in seven other localities for the establishment of Institutes, most if not all of which are likely to be successful. It sometimes happens no doubt that an Institute is established in a locality where there is not sufficient population to give it a fair chance for existence, and occasionally circumstances of a local and casual nature may lead to failure; but, as a general rule, it may be considered that when an Institute is once established in any locality both means and disposition will be found to keep it in existence; and if, through pressure of adverse circumstances, it should for a time fall into abeyance, it is pretty sure to be re-established before long. The total number of Institutes affiliated to the South Australian Institute and in active operation at the present time is 35. The following statistics of the total number of books, members, &c., of 33 of the country Institutes at the close of 1863 may not be without interest:—Books, 15,665; members, 1,473; income for year, exclusive of Government grant, £1,343. The arrangement for the delivery of lectures to country Institutes appears to give satisfaction, as the number of lectures delivered under it during the past year is greater than in either of the two preceding years during which it has been in operation; 45 lectures having been delivered at 21 Institutes between October 1, 1863, and September 30, 1864. Sub-reports of the proceedings of the Adelaide Philosophical Society and of the South Australian Society of Arts are attached to this report. It is not necessary, therefore, to refer further to those societies in this place.

Museum Department.—The sum of £250 was voted on the estimates for last year in aid of the Institute Museum. It was, however, specially voted for the augmentation of the Mineralogical Department only, and this restriction would have very materially checked the operations of the curator in other directions, had not the Hon. G. F. Angas offered a donation of £50 in aid of the Museum, on the condition that at least an equal sum should be contributed by the public. The sum of £64 was obtained, leaving, after necessary expenses were deducted, £57 to be added to Mr. Angas's donation. This increase to the funds available for the Museum has enabled the curator to make considerable additions to the various departments, more especially to that of ornithology. The vote has been partly expended in the purchase of a collection of minerals from Mr. E. R. Simpson, and of one of fossils from the Rev. J. E. T. Woods, of Penola; besides which the sum of £100 has been remitted to the Agent-General in London for the purchase of various minerals not in the Museum. These will be selected by Mr. Woodward, of the British Museum, with whom the curator has been in correspondence on the subject, and who has kindly promised his assistance in the matter. The annual report of the curator of the Museum gives full details on the various matters within his department. *Library Department.*—In addressing themselves specially to the subscribers to the Library, the Board feel that they are called upon by duty to and sympathy with their bereaved Sovereign, and by affectionate remembrance of her departed Consort, mourned and beloved alike by herself and her people, to refer in the first place to the present which was received during the past year from Her Majesty the Queen, in the shape of a copy of "The Speeches and Addresses of the late Prince Consort," with presentation inscription and Her Majesty's autograph. As the most convenient mode of exhibiting Her Majesty's present to the public, it is for the time placed in one of the cases in the Museum. Eventually a suitable case will be procured, in order that it may be preserved in the Library, where it will doubtless ever be regarded as a most interesting and touching memorial. The "Mammals of Australia," recently published by Mr. Gould, in three volumes, has been received during the year, and, as well as the "Birds of Australia," mentioned in the last report, attracts much attention from visitors to the Library. The statistics of the Institute for the past year are as follows:—The number of volumes circulated during the year was 55,417. The number of volumes in the Library, as stated in the last report, not having been subjected to any deduction on account of books lost and worn out, for the reason therein assigned, it is of course useless to make any comparison of the respective figures at the beginning and end of the present year. The number of volumes at the annual examination, as already stated, was 12,077; add to this 121 volumes then missing but since returned gives 12,198 volumes at that date; 170 volumes of ordinary books and 151 volumes Patent Specifications have been added since the examination, making a total of 12,519. From this must be deducted 175 volumes presented to the hospital and lunatic asylum, which leaves 12,344 as the actual number of volumes in the Library at the present time. The total number of new subscriptions received during the year is as follows:—Quarterly, 218; annual, 42—total, 260. The actual number of subscribers on September 30 was, as nearly as could be estimated, 944. *Report of the Curator of the South Australian Museum on the progress of the Museum during the Year ending September 30, 1864.—Aves.*—The birds added to the collection since the last report amount to 250, which, in addition to the 200 mentioned in that report, now make 450 specimens, comprising 280 species of Australian birds, among which are many rare birds from the north-east coast and elsewhere, some of which have been procured by purchase and others by exchange. *Mammalia.*—About a dozen specimens have been added, mostly small animals, natives of the colony. *Pisces.*—Twenty different species of the fish of St. Vincent's Gulf have been presented to the Museum. *Reptilia.*—Numerous additions have been made, principally by exchanging with other museums. The collection now contains several hundred specimens in spirits, among which are many rare and some new species of our reptilia. *Insecta.*—A few specimens have been added from New South Wales, Western Australia, and elsewhere, and some cases of attractive insects from the Indian Archipelago have been kindly lent for exhibition by Mr. C. A. Wilson, and a large collection of Australian Buprestidæ has also been lent by the Curator. *Mollusca.*—A small collection of European land and freshwater shells, also a few Australian shells, have been added to the collection. *Crustacea.*—Donations of several small species of crabs, &c., have been made. *Mineralogy and Geology.*—Many donations have been made of South Australian minerals and fossils, and a small but choice collection of minerals has been purchased, consisting principally of our copper and other ores; also an interesting collection of tertiary fossils from various localities has been purchased, consisting of about two thousand specimens and comprising seven hundred species. *Coins.*—A few coins, among which are some of great rarity, have been presented. *Miscellaneous Articles.*—A large assortment of native mats and other objects of native manufacture have been presented by Mr. George Taplin, of Point Macleay, and several similar objects by Messrs. G. B. and S. Yeates, of Brisbane; also some native weapons, from South Africa, by Mr. C. B. Jacobs. *Abstract of Proceedings of the South Australian Society of Arts.*—In reviewing the doings of the Society for the past year, it may be mentioned that, in pursuance of the plan of quarterly lectures, the first (on "Sculpture") was delivered by his Lordship the Bishop; the next (upon "Engraving") by L. J. Pelham, Esq. Unfortunately, from various causes, these lectures were very poorly attended; and it is suggested that it would be better to make similar lectures form part of the Institute course, or to reserve them until the Exhibition is open. The seventh Annual Exhibition was opened on the 1st December, in the rooms of the Institute, and comprised about 400 works of art. It remained open 27 days, and the total attendance was 2,793 persons. Some days were made free days, and on one of these (the day after Christmas) the attendance was 970 persons. The artists' prize list numbered 24, and amounted to the sum of £76 13s., of which 16 prizes were awarded—there being no competition for the others—and two special prizes were given. The names of the successful artists are G. Hamilton, A. Hunt, C. B. Labatt, J. Macgeorge, C. W. May, R. E. Minchin, J. D. Stone, E. Tomkinson, T. Ward, and E. M. Wilson. The distribution of Art Union prizes took place on the 30th December—the chair being taken by the Hon. John Hart, M.P.—and prizes to the value of £120 were distributed amongst the subscribers. During the Exhibition his lordship the Bishop and Mr. Pelham repeated their respective lectures to numerous and attentive auditories. Subjoined is the report of Mr. Hill, Master of the School of Design:—"I have the honour to report that for the year 1864 the progress of the pupils of the School of Design has been very satisfactory, but a great want of new models is felt, especially by the more advanced pupils. I trust the Society will soon be in a position to supply this desideratum. The total attendance for the nine months of 1864 was 30 students, of whom 14 were male students and 16 female students, and the maximum monthly attendance was 17, while the minimum was 13. The attendance was more equal than formerly. The branches of study were apportioned in the following manner:—From the flat, including outline, 8 pupils; drawing in colours, 5; mechanical and geometrical drawing, 5; drawing from the round, 4; drawing from nature, 4; free-hand drawing, 3; design, 1; total, 30." *Abstract of Proceedings of the Adelaide Philosophical Society.*—At the monthly meetings held during the year papers have been

read in the following order:—C. A. Wilson, Esq., on "The Entomology of the East Indian Archipelago and Southern Africa;" His Honour the Chief Justice, on "The Relation of Science and Theology;" Rev. J. Maughan, on "The Microscope;" George Windsor Earl, Esq., F.A.S., on "Artificial Shell Mounds;" Robert Kay, Esq., on "Ingenious Solutions of Mechanical Problems, as exemplified in Sir William Armstrong's Hydraulic Machinery and in Nasmyth's Direct-Action Steam Hammer;" C. A. Wilson, Esq., on "Wood-eating Insects;" B. H. Babbage, Esq., on "The Vital Statistics of South Australia." At the October meeting Dr. Muecke, of Tanunda, exhibited his valuable microscopic sections of Australian woods, at the same time giving much interesting information of a scientific character. The desirability of adding to the library some of the volumes of the "Royal Society's Transactions" and other issues of a kindred character, having frequently been urged by several of the members, it has been resolved to spend, under the direction of the Council, about £50 in standard books bearing on science and philosophy. During the year several new members have been elected, and several valuable reports and scientific papers, received from the neighbouring colonies and Great Britain, have been laid before the Society. In March last a very successful microscopic *soirée* was held—His Excellency the President in the chair—when a large attendance of ladies and gentlemen was secured, and a pleasant evening spent in examining a number of valuable microscopes, diagrams, and books kindly lent for the occasion by the members and other gentlemen interested in science. At this meeting his honour the Chief Justice, on behalf of the Philosophical Society, presented a beautiful and complete photographic apparatus to John Howard Clark, Esq., in acknowledgment of unwearied and valuable services rendered by him during the period of his secretaryship.

DUBLIN INTERNATIONAL EXHIBITION.

Great preparations are already being made by the Executive Committee for the musical part of the opening ceremony, on the 9th May. The orchestra will be arranged after the model of the one at Birmingham. The organ, which will be very large and complete, is building by Messrs. W. Hill and Son, of London. The number of performers will reach 1,000, and the whole will be under the direction of Mr. Joseph Robinson. It is intended to make the music, on this occasion, as great a success as it was at the opening of the first Irish Industrial Exhibition at Dublin, on the 12th May, 1853. Vocalists are to be invited and selected from the choirs in Liverpool, Manchester, Bradford, Leeds, Birmingham, and other towns and districts within easy travelling distance of Dublin.

Manufactures.

OPERATIVE COACHMAKERS' INDUSTRIAL EXHIBITION.—This Exhibition, which is to be held in the Corporate Hall of the Worshipful Company of Coach and Harness Makers, Noble-street, St Martin's-le-Grand, will be publicly opened on Wednesday, February 1st, by the Marquis of Lansdowne, who is expected to arrive at noon. An address from the Committee of Management will then be read to the chairman of the day, and the Very Rev. H. H. Milman, D.D., Dean of St. Paul's, will offer up a Prayer. An anthem will be performed by amateurs, being coach operatives; at the conclusion of which the chairman will declare the Exhibition open. The amateur singers have kindly offered to sing again during the evening, and occasionally each week during the time the exhibition is open. By permission of Lieut.-Col. Lord Truro, a Guard of Honour of the 4th Middlesex (West London) Rifle Volunteers (Coachmakers' Companies) will attend, under the command of Captain Woodall. The prizes offered by the Society of Arts, the Coachmakers' Company, and others, will be awarded by the following judges:—The Marquis of Lansdowne, Viscount Torrington, Mr. R. C. Mansell, of the carriage department, South-Eastern Railway, and Messrs. Hall, Rock, and Large. The first three were appointed by the Council of the Society of Arts, and the rest by the Coachmakers' Company.

Commerce.

SUGAR IN SPAIN.—Mr. Consul Marks, in his report on the trade of Malaga, states that the cultivation of the sugar-cane and the crushing, manufacturing, and refining of its juice has increased rapidly during the last few years; all lands capable of irrigation are being converted into sugar-cane plantations within the range of the temperate sea-coast climate, or the provinces of Malaga, Granada, and Almeria, commencing at Marbella on the west coast, and reaching to Adra on the eastern side. The climate appears particularly favourable to its growth, and the canes in some districts reach the largest size attainable by this plant; modern appliances in machinery have given an impulse to this important branch of industry which promises a rapid increase in its production. Notwithstanding that Spain has been supplied with sugar from its rich colonies in the West Indies, there has been and there still exists a protecting duty of 74 reals the 100 kilos, or about 19s. per cwt., levied on all importations from her possessions, and more than double that amount if from foreign sources. It was expected, on the late revision of the Spanish commercial tariff, that this protective duty would have been reduced; but the representatives of the agriculturists and manufacturers of the sugar-growing districts succeeded in preventing this contemplated reduction, which was borne out by statistical information, showing the enormous increase of the national cane plantations and the extent of the capital invested in this twin source of national production and manufacture. In the year 1848 this branch of agriculture might have been considered so trifling as scarcely to deserve mention; but in the year 1862, the production of sugar-cane sent to the respective manufactories may be estimated as follows:—250,000 arrobas from Nerja, 130,000 from Frigiliana, 100,000 from Maro, 350,000 from Torrox, 700,000 from Velez, 300,000 from Malaga, 1,500,000 from Motril, 470,000 from Adra—total, 3,800,000 arrobas. Say about 4,000,000 arrobas, or 45,000 English tons, yielding about 15 per cent. of sugar, or about 6,750 tons of refined sugar. The fanega or acre of land yields about 2,000 arrobas of sugar cane, which, at 14 cuartos, or about 4d. per arroba = rls (vn.) 3,305; expenses of cultivation rls (vn.) 1,500; or about £20 per fanega clear profit to the manufacturer. 2,000 arrobas will produce about 120 arrobas of sugar, which, sold at rs (vn.) 30 each, amounts to rs (vn.) 3,600; from which are to be deducted for expenses, rs (vn.) 1,146; profit, rs (vn.) 2,454, or about £24 profit on the reduction to sugar of the 2,000 arrobas of cane. About 10,000 acres of irrigable land are occupied in the growth of the sugar-cane along the southern coast of the Province of Granada, and these ought to produce 5,400,000 arrobas of sugar-cane. Twenty sugar factories exist in the district before mentioned; eight are first-class establishments worked by steam on the modern system of refinery; the other twelve are on the old plan of refinery, by boiling in the open air. About 5,000,000 of reals, or £50,000, may be considered as the amount of capital invested in the agricultural growth of the cane, and about 40,000,000 reals, or £400,000, in the construction and machinery of the twenty factories and refineries, requiring about 20,000,000 of reals, or £200,000, floating capital to keep them in constant work. The great drawback offered by the French Government to the exporters of French sugars helps in some degree to keep down the profits of the Spanish manufacturer, the drawbacks paid

this year on exportations of sugar in France having greatly exceeded the amount received by the French customs on importations of foreign sugar; the introduction of the article into Spain from France amounts to 160,000 arrobas of 25 lbs. each, or 2,000 tons, the drawback enabling the French to undersell the Spanish refiner, although their sugars are amenable to the heavy import duty. Sugar has risen lately in price as much as 8s. the hundred-weight, owing to the failure of the crops in the East Indies creating a deficiency of about 50,000 tons; and to the crops of beetroot in Russia and Poland having likewise proved a failure. In the Havana little sugar remains in consequence of the quantities taken in America. The Brazilian crop being late, will be exposed to the habitual rains at the end of the year. In the West India islands the cane has suffered from a long drought. In the Mauritius and Reunion the deficit is estimated at from 30,000 to 35,000 tons. In Louisiana the yield is quite insignificant. The demands from America are calculated at from 30,000 to 35,000 tons. The beetroot in France is suffering from the attacks of a parasite known as the *uredo betæ*, the destructive effects of which have been increased by the dryness of the past season. The general opinion is that the crops this year will not exceed one-third of the average; while in Spain the lands availed of for the growth of the canes are mostly irrigated from sources little affected by the rainy or dry seasons, and thus the crops have generally been of a fair average production.

Trade with Austria.—The Austrian Government has called upon all the Chambers of Commerce in that country to furnish reports containing the statistics of the trade with England since the Anglo-French Commercial Treaty came in force, the object being to ascertain what effect that Act has had on the imports from Austria into England, and what advantages might be derived from a similar treaty between the two last-named countries.

Exhibition of Fishing Tackle.—The authorities of Boulogne have decided on organising in the course of the present year an Exhibition like that which took place some time since at Amsterdam, of fishing tackle and utensils, and all kinds of instruments connected with the maritime industry of all nations.

Find of Coal in Mexico.—A deposit of coal of the best quality has, it is said, been discovered in the mountains of Itoluca, at the distance of thirty leagues from the city of Mexico, and of sixty from Acapulco. Another deposit was discovered some little time since in the district of Tlajcala.

Colonies.

Gold in Tasmania.—For years past gold has been produced from Fingal in considerable quantities, by odd stragglers, rudely provided with means of searching for it,—yet never sufficiently to infect people with a gold-digging mania and produce a rush. The quartz reefs have been tested by imperfect machinery. They have always turned out more gold to the ton than many of the average reefs that pay well in Victoria; yet, strange to say, they have never been considered of sufficient importance to attract the attention of capitalists, by whom alone they can be profitably worked. The first reef worked by the original Fingal Quartz Mining Company was very paying, twenty, thirty, and forty ounces of the precious metal regularly once a week rewarding the workers for their labour and their research. Flushed with the success of these their primary efforts, it was determined by the original quartz miners to go to work upon a new and more extensive basis. The company was augmented—and its capital increased to £12,000. New machinery, of a most expensive quality, was obtained from Messrs. Russell and Co., the eminent machinists of New South Wales; and works were completed of a very comprehensive character. But, strange to say, from the day of opening no gold was taken from the original reef of the Fingal Quartz Mining Company. This was caused through the machinery being of an imperfect and impracticable character. Since then little has been done to develop the undoubted gold-bearing quartz veins that exist near Fingal. The failure of the extensive company alluded to has so blighted the hopes of many of the Tasmanian colonists, that unless capitalists from the adjoining colonies proceed with the works, little will be done. During the late session of Parliament one of the members for Launceston introduced the matter of the gold fields to the House of Assembly, and asked parliament to grant £2,000 for the purpose of engaging Mr. Hargraves, the eminent gold discoverer, to prospect the country. That hon. member was met by the remark, that there was an Act of Parliament in existence which offered a reward of £5,000 to the person who would indicate the whereabouts in Tasmania of a gold field that was capable of producing, and absolutely produced for twelve months, gold at the rate of 100 ozs. per week. And no member would second the proposition. It was however determined that if Mr. Hargraves would come to the colony they would endeavour to secure his services without government aid. Accordingly public meetings were held, and subscription lists opened, the public liberally responding to the call. When Mr. Hargraves landed in Tasmania, an extraordinary ovation awaited him. The whole country was rejoiced to think that at length, with the aid of the great gold prospector, the question that had so long agitated the public mind would be solved. A most influential deputation waited upon the ministry, and were informed that the Government were anxious and willing to assist them by every means in their power, and that they would place £1,000 at the disposal of the Committee, to be appropriated in the prospect of gold, provided Mr. Hargraves, after his preliminary observations, reported it was necessary. This liberality on the part of the Ministry has been everywhere received with the utmost satisfaction. Mr. Hargraves has departed to Fingal to commence operations.

Notes.

Railway Bridge over the Seine.—The Western Railway of France is now constructing a short line to connect the town of Rouen directly with the Paris and Cherbourg Railway, and the work includes a bridge over the Seine near Elbeuf. This construction will be more than 650 feet long and eighteen feet wide, and will rest on five series of tubular cast-iron piles, with intervals of about 160 feet between them. The bridge itself has been constructed on the banks of the river, and is now being placed on the piles, the entire structure, 200 metres long, being pushed forward by means of very simple arrangements from one side of the river to the other. The operation was commenced some time since, when the end of the bridge rested on the third set of piles after eighteen hours work. The weight of the bridge is given at a thousand tons, and the movement was given by sixteen men. The bridge is the work of Messrs. Schneider and Co., of Creusot, who adopted the same method in the case of the viaducts of Fribourg, in Switzerland, of Romans, on the Isère, and of Saint-Just, on the Ardèche.

College of Organists.—A society under this name has been instituted for the purposes of improving the position, advancing the interests, and encouraging the skill —both in composition and performance—of all who follow the occupation of an organist; and in its sphere of operation is included lectures, concerts, prizes, opportunities for the interchange of opinions among organists, the granting certificates of merit, and such other means as may appear to the government for the time being as best calculated to further the objects of the institution.

Cab Indicator.—The French authorities have for a long time occupied themselves with plans for checking the distances as well as the time of public vehicles; the old system of *courses*, single journeys within the limits of the city, has ceased to be fairly applicable since the limits of Paris were extended to the fortifications; the uniform charge for a ride of twenty minutes (for there is now a minimum rate for a journey of not more than a quarter of an hour) and for one of an hour is clearly unjust both to the proprietors of vehicles and to the public, and the circumstances of the case demand a re-adjustment of the system. The municipal authorities of Paris have, therefore, urged the company to which the public carriages belong to use its utmost endeavours to find a means by which payment by distances may be regulated. Many attempts have been made without success, but a metre, invented by MM. Meuley and Verdier, seems to hold out some promise, and three have been placed in cabs belonging to the company. This instrument has two faces, which indicate—First, the distance passed over; secondly, the time occupied in so doing; and thirdly, the stoppages, which are added to the distances at the rate of eight kilomètres, rather less than five miles, an hour. Should this new metre be found to answer in practice, there will be no difficulty between the hirer and the driver, as the former may engage a carriage either by time or distance. But the apparatus attempts more than this; it contains a card, on which it marks all the *courses* made during the day, the time employed, and the number of kilomètres paid for by the public, and consequently the sum which the driver has received. It is declared that all this has been accomplished, and, if so, there is no question that the application of the apparatus will soon become general; but unless the action of the metre is arrested when the carriage is moving, though unoccupied, the driver would stand charged with the distances passed over from and to the stations and the places where he takes up and puts down his fares. This cannot, however, have been overlooked, and it is to be hoped, for the sake of all concerned, that the problem may have been solved.

Photographic Maps.—A map of the town of Grenoble and its environs, embracing twenty square kilomètres, has been produced with the aid of the camera in a very short space of time. The immediate object in view is the obtaining correct topographical profiles for military purposes, and, consequently, the means of placing an attacking force comparatively out of the reach of danger, but maps showing the undulations of the land are of too evident utility to require any special application to illustrate their value. The map in question is made to a scale of one in five thousand, and was entirely produced in Paris from twenty-nine photographic views taken from eighteen different points, by Captain Javary. The stations selected were partly on one side of the river Isère, and partly on the other, and it is believed that not a single accident of the outline has been missed. The extreme elevation of the ground on the right bank of the river is more than three thousand feet. The shortest distance at which a view was taken was about a thousand yards, the greater part were at fifteen hundred yards, and some few as distant as four thousand five hundred. It is stated, on the authority of M. Laussedat, with whom the plan originated, that fitting of the levels is such as could not have been produced by any other known method of expeditious military reconnaissance. The views were taken by two lenses of different focal lengths, namely, one of 50 centimètres, the other of 27. The former was employed for tolerably large representations and objects at a distance, or where it was found necessary to take special notice of details, and the other, which took in a field of 60°, for the shorter distances. The photographic operations only occupied about sixty hours, and the subsequent preparation of the map two months.

Correspondence.

Propelling Railway Trains on Lines with Frequent Stations.—Sir,—The paper on this subject read on Wednesday, the 18th inst., and the discussion which followed, do not seem to go far towards a solution of the difficult question of the propulsion of underground railway trains. Mr. Barlow proposes the long-abandoned rope traction, on a new plan, which might be called the "cross-bow" system; while Dr. Bachhoffner would recommend what he calls the "tea-urn" principle, on a rather large scale; others, again, advise the adoption of what may be called the "Enterogaster" engine, which is not only to swallow its food and water, but to digest and consume its stomach also. Mr. Barlow's plan is undoubtedly practicable, though occasioning a certain waste of tractive power; but the great objection is that with rope traction the driver does not accompany the train, and this, therefore, will never become popular. The expense of Dr. Bachhoffner's recommendation would, if practicable, absorb the whole revenue of the company, and leave nothing for profit and repairs. Lastly, the engine that is to swallow its own breath and smoke would appear to be quite contrary to nature, and approaches somewhat to the character of that grand desideratum of patentees and inventors, the perpetual-motion machine. The professed object of these and other contrivances is to obviate the vitiation of the atmosphere of tunnels. Now, the air in the tunnels of the metropolitan lines is quite as pure and wholesome as the atmosphere above ground, as must be the case from the ends of the tunnels being open, the frequent air shafts, and rapid passage of the trains both ways. But those tunnels are subject to the inconvenience which attends all open-air trains in an equal if not greater degree, the intolerable and disgusting nuisance of the present system of brakes. The burning of the wooden chock on the iron wheel produces a sulphurous stench that is almost unbearable, even in the open air; and it is a singular fact that none of the contrivances of engineers and inventors tend at all to diminish this evil, but rather to increase it. There are only two practicable modes known to us at present of avoiding the necessity of carrying a coke furnace through the tunnels,—the vacuum system, originally invented by Mr. Vallance, of Brighton, of sucking the entire train, with its load, through the tunnel; and the compressed-air locomotive. Vallance's plan is essentially economical, as a two-inch vacuum is amply sufficient for the heaviest loaded train. Its durability is unquestionable, but it is scarcely adapted for repeated stoppages at short intervals. The compressed-air locomotive is perfect in every respect, and, therefore, deserves every attention from inventors and improvers. Common air may be compressed to any degree of density with facility and economy by means of the triple compound condenser. The portable reservoirs, or salamanders, can be taken out, and charged ones replaced, in far less time than taking in coke and water, not to mention raking the fire bars. The extraordinary lightness of the compressed-air locomotive cannot be allowed to be an objection, because the whole train of carriages may be lightened in the same proportion. The enormous quantity of iron and oak introduced in the manufacture of an ordinary railway train car is quite absurd when considered in reference to the load carried,—less than two tons,—a load that is carried on common roads in vans not a quarter the weight of a railway car. The standard objection to the compressed-air locomotive is the assertion that no salamander of practicable size would carry a train more than two or three hundred yards. But if that assertion be founded on fact, which is very doubtful, why are not our inventive powers directed to the improvement of the air locomotive, and the general lightening of the machinery and construction of railway trains? The obvious answer to this question is the formidable fact that change of system is abhorrent to the vested rights of patentees, holders of

immense stocks of moulding and other patterns, and the rolling stock of existing companies.—I remain, &c., Henry W. Reveley.

January 23rd.

Propelling Trains on Lines with frequent Stations.—Sir,—If I understand Mr. Barlow's meaning rightly—and I am by no means sure that I do—for, like the old Scottish lady, I feel "it is a sort o' presomption to onnerstan the meenister," his new proposition of working railways is by a sort of kick, or succession of kicks, to the train, not directly, as in the plan of Mr. Pilbrow, shown in the Exhibition of 1862, but indirectly through the agency of a rope, to be acted on by a steam-engine driving a pair of wheels to haul on the rope; or by Sir W. Armstrong's water column; or by some other means. But the essence of it is to put in practice the principle of the tennis or cricket ball—a sudden shock instead of a gradual movement. When we play at bowls, using the muscular force of the arm as a propeller, the bowl is a rigid block of wood, and takes no harm, because there is a gradual force applied. So also when we strike a billiard ball with a cue. But with the cricket bat or racket we use an elastic ball. With Mr. Barlow's huge bat, weighing forty tons, we must give a very powerful elastic recipient to the train, to elude the shock and prevent the breakage of the rope. We must also attain great skill in striking the blow, to be sure we drive the train-ball far enough. But even then there seems a difficulty. Mr. Barlow's objection to the locomotive is that it is gradual in attaining speed; but we can carry that speed on for any length of time when attained. On Mr. Barlow's system we are supposed to start with a given velocity, but that velocity goes on gradually decreasing, and unless there be a succession of batters, there would be the risk of stopping midway before arriving at a station. And for this Mr. Barlow's remedy is a supplementary locomotive, and of course rails for it to run on, and sidings to get out of the way. Experience in the use of ropes for traction rather points to the use of slow motion, to avoid breakage; but as Mr. Barlow aims at increased speed he will have to provide such an amount of elastic action to graduate the force as will seriously detract from his incipient speed. All that Mr. Barlow can gain is the saving of the dead weight of the locomotive; but, so far as we can discern, this will be more than counterbalanced by other disadvantages. It is true that there may be more in the scheme than we have yet perceived, but as Mr. Barlow has not shown us a specific mechanical plan, and the whole is a question of mechanical structure, and his explanations have not been remarkable for lucid clearness to common understandings, we must wait in patience for further information. Mr. Chubb is quite right in saying that "the motive power should accompany the train;" but whether, under the necessity of getting rid of noxious gases, this can be accomplished by external power generated and transferred to the machine, is still a problem, whether in the form of compressed springs, or air, or highly elastic steam. If external power is to be applied in the shape of haulage, the most promising is the exhaust system of Vallance, a variation of which is now being experimented on by Mr. Rammell. If wire saucers in the shape of sheeves were used to carry a rope in the tunnel, as on the Blackwall, the noise would be something fearful. Train resistance by gravity, mechanical friction, and atmospheric impediment in the tunnel, up the gradient of 1 in 100, is stated by Mr. Burnett to be 66 lbs. per ton. If this resistance could be reduced there would be more advantage than by Mr. Barlow's plan. Supposing the ordinary resistance up 1 in 100 to be 40 lbs. per ton, there is 26 lbs. surplus arising from atmospheric resistance and train friction, and it is worth while considering how far the latter may be reduced. Reducing resistance is equivalent to reducing the consumption of fuel and the production of noxious gas. Practically, so long as the Great Western and Great Northern are to run ordinary engines over the metropolitan lines, the only question worth considering is, how to prevent the destruction of rails and tires.—I am, &c., W. Bridges Adams.

Petroleum as Steam Fuel.—Sir,—Much interest is still expressed by our naval authorities, and by others connected with steam navigation, as to the proposed use of petroleum as fuel; and there is such a desire for information on the subject by many who confess being unable to judge as to the merits of this project, though they fully appreciate the importance of any mode of improving or economizing the use of fuel and augmenting its efficacy in practice, that I should be obliged if you would allow me to make some comments upon the subject more especially in reference to the position it has now assumed. The data relating to the comparative calorific power, or heating capability of petroleum and of coal, which I have already referred to,* are not disputed by the advocates for the use of petroleum as fuel; on the contrary, they are adopted by them. So far, therefore, we are unanimous. But, in reply to the objection which I have urged on the ground of cost, they suggest that the price of petroleum might perhaps be reduced if it came to be used as fuel; and if not, they believe that the lower cost—£10 to £12 per ton—at which a material almost identical with petroleum may be obtained from coal, would admit of that being used for fuel. So far as the price of petroleum is concerned, I am disposed to consider any anticipation of a reduction in price extremely delusive; and in reference to the lower price of coal oil, it will be sufficient to say that it would merely render the substitution of that material for coal less disadvantageous than a similar use of petroleum, and that the comparison between these materials, as fuel, would still be considerably in favour of coal. But the chief argument in favour of using petroleum as fuel is, that this material admits of being used for that purpose, in a manner so much more advantageous than is possible in the case of coal, that the disproportion in the cost of the two materials would be more than counterbalanced. They contend, also, that the relative advantages of petroleum and of coal cannot be determined by theoretical considerations, relating to the respective heating capabilities of these materials, and that they must be measured by the effects which can be produced in the two cases. In fact, the subject must be considered practically, and not theoretically. With this view I fully concur, and for that reason I regret that no practical evidence of the comparative effects or duty obtainable with petroleum and with coal, has yet been brought forward. It was only from the want of such practical evidence that I was led to have recourse to a theoretical consideration of the relative heating capabilities of petroleum and of coal, as the only accessible criterion by which an opinion could be arrived at as to the very startling statement that a ton of petroleum is equal to five tons of coal as fuel, and by which the wonderfully erroneous nature of that statement could be rendered apparent. It would have been far more satisfactory to myself to have based my opinion upon the results of trustworthy experiments, representing the actual duty obtained with petroleum and with coal. Nor can I refrain from expressing my surprise that a statement so extraordinary as that I have referred to should have been put forward ostensibly as the result of experiments in the Government Dockyard, with an appearance of authority which it acquires from the mode in which it has been made public, and without a vestige of practical evidence to support it. This is indeed the more remarkable from the fact that the advocates of petroleum appear to have been quite cognisant of the proper mode of instituting a practical comparison between different kinds of fuel. In the absence of such evidence, mere argument and assertion have but little value, and it is incumbent on those who have excited an interest in this subject to put their views to the test of experience, and either to substantiate them satisfactorily or acknowledge their error.

*See *Journal*, Vol. XII., p. 311.

But, in reference to the possibility of using petroleum as fuel more advantageously than coal, there is a means of instituting a practical comparison between them, which, in the absence of any more direct criterion, is deserving of notice. It is well known that no kind of fuel is burnt under ordinary circumstances so as to realise the whole of the heating effect it is capable of producing. The true comparison between different kinds of fuel is, therefore, not what they can do, but what they really do in practice. The actual work done by any kind of fuel depends partly upon its nature, partly also upon the kind of effect to be produced. When coal is burnt in smelting iron, for instance, the amount of its heating capability which is actually utilised, is not a tithe of that which is utilised when coal is burnt in an ordinary domestic grate; but in the one case the effect to be produced is the maintenance of an intense degree of heat; in the other, moderate warming only is required. In burning coal under the very unfavourable conditions which obtain in a marine-boiler furnace, experience has shown that there is a great difference in the duty or effect produced by equal quantities of different coals possessing equal heating capability. Hence the recognised practical superiority, for steam-vessels, of Welsh steam coal over the more bituminous kinds of coal represented by North Country coal. Now, what is the difference between these two kinds of coal to which their different value as steam fuel is referrible? It is simply this; the Welsh coal is almost entirely fixed, approximating in this respect to pure carbon; it does not give out much combustible gas when heated, but it burns almost entirely within the furnace, and, unless the rate of combustion be very rapid, it burns completely, generating its full equivalent of heat, which is transferred, through the medium of the combustion products, to the water in the boiler. But bituminous coal, though of equal heating power, contains from 30 to 40 per cent. of volatilisable substance, and consequently, when heated, it evolves combustible vapour or gas to that extent; and this, mixing with the combustion products, is thereby rendered less readily combustible, and before it can be burnt it is drawn into the tubes of the boiler, where the flame is extinguished partly by the cooling of the gas and partly by the want of air, so that, instead of generating its equivalent of heat, it produces soot and smoke. This action takes place to some extent with all coal, especially when it is burnt under such unfavourable conditions as obtain in a marine-boiler furnace; but it is the degree in which it takes place that determines the relative value of different coals for steam navigation. The more a coal is capable of being burnt within the furnace the better it is for this purpose. The greater the amount of volatilisable substance it contains, the less suitable is it, and the greater is the extent to which production of soot and smoke is substituted for the production of heat; and, as these are correlative results, it follows that the fitness of coal for steam navigation is inversely proportionate to the amount of volatilisable substance it contains. At least this is, within certain limits, the case as regards the kind of boilers now in use. Applying this result of long experience to the case of petroleum, the conclusion which it leads to is even more disadvantageous for that material, as compared with coal, than the comparison of their theoretical capabilities; for petroleum is altogether volatilisable, and consequently it appears to me that there is nothing more incompatible with the use of petroleum as fuel than the conditions which obtain in a marine-boiler furnace. Doubtless it will be said in regard to this opinion that a peculiar boiler is contemplated for petroleum, but as to that nothing need be said until we are in possession of results indicating the evaporative effect attainable with petroleum as compared with coal. The signal misconception which characterises the views of those who advocate the substitution of petroleum for coal in steam navigation was most strikingly illustrated during the discussion which followed the papers read on this subject by Capt. Selwyn and Mr. Richardson, at the United Service Institution; and to show the confusion of ideas prevailing on the important subject of fuel, I need only mention that Sir Edward Belcher referred to the oxhydrogen flame, as proving the fuel value of hydrogen to be much greater than that of carbon or of coal. Nothing could possibly be more irrelevant, and it can only be inferred that Sir Edward Belcher is not aware that the thermal efficacy of the oxyhydrogen flame is solely due to the fact that oxygen gas is used in the place of air in the combustion. This circumstance alone places the case of the oxyhydrogen flame beyond the range of a practical consideration of the subject, and so far as comparison can be instituted between hydrogen and carbon when burnt with oxygen in place of air, the fact is that the thermal effect or temperature produced by carbon under that condition is far greater than that which is produced by hydrogen; these effects being in the ratio of about 10 : 7 for equal weights of carbon and of hydrogen. When these substances are burnt with air, the difference in thermal effect is inappreciable. Capt. Selwyn's reference to the common fish-tail burner used for illumination, and to the Bunsen burner used for heating, as being illustrative of the different effects obtainable by burning combustible substances under different conditions, was equally infelicitous; for in the flame of the fish-tail burner, and in that of the Bunsen burner, the heating effects produced are equal for equal quantities of gas burnt, and the thermal effects or temperatures produced are but little, if at all, different. The feasibility of the same gentleman's opinion as to the possibility of substituting coal oil for coal as steam fuel, may also be illustrated by the following simple consideration. Of the very richest oil-yielding Cannel coal—the Leeswood Cannel—about three tons are required to produce one ton of crude oil. In the production of this oil a considerable quantity of combustible gas, capable of generating a large quantity of heat, is lost, and there remains the greater part of the carbon of the coal in a state of coke, amounting to much more than one ton. So that the true fuel value of the oil from three tons of coal is really the fuel value of that quantity of coal, *minus* the fuel value of the coke and gas. Now, according to the representations made in favour of substituting coal oil for coal as fuel, one ton of oil is expected to do the work of five tons of coal; so that, according to this view, the fraction of the heating power belonging to the three tons of coal will be equal to the heating power of five tons of coal! This is equivalent to the proposition that half three is equal to five, and is comparable in absurdity with the wildest speculations concerning perpetual motion. That such a common-sense view of the subject should have escaped the perception of the gentlemen who propose to improve and economise the use of fuel, so as to bring about an entire reorganisation of our navy, and of steam navigation, is a fact which indicates a most woeful deficiency of acquaintance with the subject, and which well illustrates the proverbial danger of a "little knowledge." In conclusion, I would recommend the advocates of the use of petroleum to have recourse to that practical mode of deciding any question there may be in their minds as to the relative fuel value of petroleum and of coal, which I fully agree with them in thinking is the only satisfactory test, and which I have no doubt will bring them that conviction which is consistent with the real facts of the case.—I am, &c., B. H. Paul.

8, Gray's-inn-square, Jan. 18.

Hot-Air Blast from Copper instead of from Iron Tubing.—Sir,—I have lately made some experiments, and think that hot air from copper will do good service in the manufacture of colonial sugar. 1st. By heating the cane in chambers so as to decrudify or unraw the whole previous to crushing in the mill; the effects will be softening of the cane, and rendering it so as to give forth its juice devoid of admixture with glucose or such like, which causes decomposition to the juice, and necessitates the use of lime to temper or rectify such acidity, 2ndly. The hot air will do to force into juice in earthen-

ware pans, and so effect concentration without burning, as at present, with fire underneath vessels. Copper tubes are more ductile than iron, can be more readily mended, and never burst.—I am, &c., C. M. Dick, Sugar Planter, late of Trinidad.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Arts, 8. Cantor Lectures. Mr. B. Waterhouse Hawkins, "On the Reproduction of Natural Forms by Art and Manufacture." Lecture V.
Actuaries, 7. Mr. Peter Gray, F.R.A.S., "On a Table for the Formation of Logarithms and Anti-Logarithms, to Twelve Places of Decimals." (Part 2.)
R. United Service Inst., 8½. 1. Lieut. Walker, "Coast Railways and Railway Artillery." 2. Mr. T. Wright, "Models of Railway Artillery for Coast Defence."
Tues. ...Civil Engineers, 8. Discussion upon Mr. Hawthorn's Paper, "On the Docks and Warehouses of Marseilles."
Anthropological, 8.
Royal Inst., 3. Prof. Tyndall, "On Electricity."
Wed. ...Society of Arts, 8. Mr. J. Chalmers Morton, "On London Sewage from the Agricultural Point of View."
Pharmaceutical, 8.
R. Society of Literature, 8½.
Thurs...Royal, 8½.
Antiquaries, 8.
Linnæan, 8. Mr. Charles Darwin, "On the Movements and Habits of Climbing Plants."
Chemical, 8. Dr. Hofmann, "On Lecture Illustrations."
R. Society Club, 6.
Artists and Amateurs, 8.
Royal Inst., 3. Prof. Tyndall, "On Electricity."
Fri.......Philological, 8.
Royal Inst., 8. Dr. Odling, "On Aluminium, Ethide, and Methide."
Archæological Inst., 4.
Sat.......Royal Inst., 3. Prof. Marshall, "On the Nervous System."

Patents.

From Commissioners of Patents Journal, January 13th.

Grants of Provisional Protection.

Power looms—3200—E. Fielding.
Pumps, ordinary lift and force—11—M. Benson.
Railway carriages, lamps for—3212—J. Parkinson.
Railways, communication between passengers and guards travelling on—3109—A. R. Croucher.
Railways, fastenings for—3233—M. A. Muir and J. McIlwham.
Railways, girders for—3243—E. Shufflebotham,
Railway trains, apparatus for signalling in—3227—W. H. Preece and A. Bedborough.
Railway trains, signalling between the passengers and the guard and driver of—3218—W. Buttrum.
Railway wheels, construction and fitting of—3202—E. Leahy.
Rotative motive power—3247—E. Couprant.
Saws—3072—G. Rooper.
Ships, saving from sinking—2179—J. Smith.
Spectacle frames—2655—P. A. Le Comte de Fontainemoreau.
Stamping apparatus—3051—A. Albert.
Steel and iron, manufacture of—3073—J. Ramsbottom.
Tea-pots, coffee-pots, &c.—3206—T. Robinson.
Textile fabrics—3157—P. Cameron.
Umbrellas, &c., top notches and runners for—3220—H. Johnson.
Water, &c., apparatus for measuring—3145—C. W. Orford.
Yarns, mode of treating warped—3226—W. Holms.

Invention with Complete Specification Filed.

Ordnance, construction of—54—H. Ames.

From Commissioners of Patents Journal, January 20th.

Grants of Provisional Protection.

Artificial fuel—81—D. Gattafent and F. Pontifex.
Artificial manure, manufacture of—3161—S. P. A. de Brocalde d'Eluza.
Axles, apparatus for lubricating—6—J. Smith, jun., and J. Williamson.
Belt for ladies' wear—17—L. Goldberg.
Beverages, preparing and keeping aerated—39—T. Pickford.
Bones, extracting and purifying fats from—93—A. G. Lock.
Boots and shoes, shaping and trimming the heels of—49—G. Haseltine.
Bread, apparatus for making aerated—3184—R. L. Howard and J. Dauglish.
Bricks, manufacture of compressed—77—H. Chamberlain.
Carding engines—3253—J. Ladley.
Colour printing—3093—C. Hancock and S. W. Silver.
Cotton gins—2745—H. V. Scattergood.
Dentistry, painless—3229—J. D. Morrison.
Dyeing and printing, aniline colours for—3045—E. T. Hughes.
Eggs, keeping the substance of, fresh and sweet—47—W. C. Thurgar.
Enamelled glass, manufacture of—12—W. G. Helsby.
Enamelled wares, manufacture of—3242—B. Baugh.
Fibrous materials, flyers for preparing—69—R. A. and G. H. Lightoller.
Fibrous materials, machinery for combing—3210—T. Whitley and J. Jowett.
Furnaces, &c.—51—J. Robertson.
Gas, carbonic acid—3102—A. P. Price.
Globes, geographical—3244—E. Perce.
Hair, apparatus for brushing—3246—A. C. Robb.
Hair, brushes for the—61—T. Horrex.
Horse shoes, machinery for making—3254—W. E. Newton.
Hydrometers—75—E. W. Ladd and L. Oertling.
Iron pipes, &c., apparatus for cutting—85—W. E. Gedge.
Jack and slubbing frames—63—A. Barlow.
Jewellery, &c., manufacture of cases for—3258—R. Quin.
Joints, cutting at one operation dovetail and mitre—3228—R. H. Leese.
Knives, cleansing and polishing—26—G. Kent.
Lint, manufacture of—73—S. S. Brown.
Liquids, apparatus for measuring—20—W. Payton.
Locomotive steam engines—3232—J. Millar.
Locomotive engines—35—J. E. Wilson.
Looms—43—J. A. Castree.
Manures, manufacture of—3256—T. Richardson.
Mattress or bedstead, elastic—87—W. E. Gedge.
Meat, preservation of—79—T. B. Belgrave.
Motive power, obtaining and applying—3260—C. W. Siemens.
Ornamental fabrics, weaving—45—J. Craw and J. Macaulay.
Paper, machinery for smoothing or finishing—8—J. R. Crompton.
Perambulators—14—H. Lloyd.
Pictures, mounting—10—F. Gye.
Pistons, elastic packings for—19—E. Keirby.
Plates and strips of metal, machinery for flanging—3216—G. Alton.
Pneumatic apparatus—3230—G. Edwards.
Pneumatic apparatus, portable—16—T. J. Ashton.
Printing machinery—2863—W. E. Newton.
Projectiles—3240—R. Cail.
Railway carriages, construction of—95—R. Chidley.
Railway clerks, checking the receipts of—28—W. H. Roy.
Sails, reefing and furling—83—H. Coutanche.
Sewing machines—3238—J. H. Johnson.
Sewing machines—2—T. A. Macauley.
Sheds, railway stations, &c., construction of roofs for—3250—T. Bouch.
Steam and heat, apparatus for generating—33—J. M. Kirby.
Steam boilers, float for indicating the level of water in—3234—J. and W. Truswell.
Steam engines—3239—W. Nalder and A. Belcher.
Steam hammers—89—J. Ramsbottom.
Taps—67—J. Calkin.
Tubular boilers, construction of—37—J. C. Amos and W. Anderson.
Velvets, &c., box for preserving—3154—W. E. Gedge.
Vessels, apparatus for propelling—29—W. Watson.
Volatile fluids, lamps for burning the vapour of—41—J. C. Bayley and D. Campbell.
Watches, construction of escapements for—53—G. Reymond,
Wood, preservation of—3192—J. Bethell.
Yarns, finishing cotton heald and other doubled—3186—J. B. Edge and E. Hird.

Patents Sealed.

1846. J. C. White.	1956. G. Leyshon.
1852. E. Peyton.	1963. N. McHaffie.
1859. F. L. Lyne.	1985. J. Grice.
1897. J. F. Hearsey.	2144. E. Petito.
1904. F. E. B. Beaumont.	2486. C. H. Collette.
1921. S. Hawksworth.	2594. L. H. G. Ehrhardt.

From Commissioners of Patents Journal, January 24th.

Patents Sealed.

1854. T. B. Heathorn.	1981. W. Clark.
1872. R. Couchman.	1982. W. Clark.
1877. A. Prince.	2003. J. Adams, J. Webb, and J. J. Monteiro.
1880. E. Brimson.	2041. B. B. Stoney.
1882. J. Livesey and J. Edwards.	2359. L. Alexander and W. B. Nation.
1883. H. Moon.	2460. B. Margulies and J. K Leather.
1889. J. Nicklin.	2565. W. E. Newton.
1894. H. McEvoy.	2973. C. J. Falkman.
1896. H. J. Distin.	3047. W. E. Newton.
1898. G. A. Huddart.	
1933. A. Bain.	
1951. J. Heydon.	

Patents on which the Stamp Duty of £50 has been Paid.

123. T. Myers and E. Myers.	145. A. Lamb.
135. J. J. Stevens.	155. H. B. Barlow.
149. R. O. Doremus and B. L. Budd.	158. A. J. Martin.
156. G. T. Bousfield.	183. J. Cornforth and B. Smith.
361. J. J. McComb.	206. S. A. Carpenter.
151. J. A. Knight.	239. W. E. Newton.
	308. J. B. Payne.

Patents on which the Stamp Duty of £100 has been Paid.

81. T. Hamilton & J. Hamilton.	352. J. Chatterton.
110. P. Wilson, S. Northall, and T. James.	122. William Weild.
112. H. Smith.	100. C. Rishworth.

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111th Session.] FRIDAY, FEBRUARY 3, 1865. [No. 637. Vol. XIII.

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Announcements by the Council.

Cantor Lectures.

The Second Course of Cantor Lectures will be "On the Applications of Geology to the Arts and Manufactures," by Professor D. T. Ansted, M.A., F.R.S., and will be delivered on Monday evenings, at Eight o'clock, as follows:—

Feb. 6th.—Lecture 1.—On the Formation of Natural Soils by Derivation from Rocks, and on the Improvement of Soils by the admixture of Minerals.

Feb. 13th.—Lecture 2.—On Natural and Artificial Springs, and on the various Sources of Water Supply for Towns and Cities, in connection with the Geological Structure of the Vicinity.

Feb. 20th.—Lecture 3.—On Mineral Materials used for the Purposes of Construction: Plastic and Incoherent Materials (Clays and Sands).

Feb. 27th.—Lecture 4.—On Mineral Materials (*continued*): Building Stones and Slates, and their Relative Value under given Circumstances of Exposure, and on Methods of Quarrying.

March 6th.—Lecture 5.—On Stratified Deposits of Minerals, as Coal and Iron Ore, usually obtained by Mining Operations, and on Mining Methods for such Deposits.

March 13th.—Lecture 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture. For this purpose a set of Tickets has been sent to every member.

Final Examinations—Botany.

In addition to the Prizes in this subject offered by the Society of Arts to candidates taking a Certificate of the First Class, the Royal Horticultural Society offers five prizes, of £5, £4, £3, £2, and £1 respectively, to the five candidates being gardeners by profession, who, taking any grade of certificate in Botany, obtain the highest number of marks in that subject at the Final Examinations in April next.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

Feb. 8.—Adjourned discussion on Mr. J. C. Morton's paper "On London Sewage from the Agricultural Point of View."

Feb. 15.—"On the Claims of Authors and Inventors to Property in and Protection for Designs and Inventions first published at Industrial Exhibitions." By Thomas Webster, Esq., F.R.S.

Proceedings of the Society.

Cantor Lectures.

Fifth Lecture.—Monday, Jan. 30.

Mr. Waterhouse Hawkins delivered the fifth and last of his course, on the "Reproduction of Natural Forms by Art and Manufactures," the subject of this fifth lecture being Ceramic Manufacture, with the influence of the material on the design, and its successful production, modern terra cotta, Della Robbia ware, Majolica, Palissy ware, and Parian. The metal casting (which at the conclusion of the previous lecture was not completed in time) was exhibited to the audience. The metal having been poured, the sand mould was knocked off, and the cast of an animal in bronze metal was shown, with "gets" or channels through which the molten metal had passed. The moulds for metal casting, being made of sand, were soft and destructible, so that a fresh mould had to be made for each cast, whereas the moulds for ceramic wares were hard, and the cast was drawn from them in a semi-plastic state. Figures in metal might be cast whole, whereas figures in ceramic material were cast in many pieces from separate moulds. Ceramic or pottery wares were amongst some of the most ancient art-works of man. In the days of the ancients, Homer, while on his travels, came to a pottery; the potters being (as were all Greeks), enthusiastic admirers of poetry, bargained with Homer to give him one of their finest vases as a recompense if he would recite to them some verses

in honour of their art. This the sublime poet thought it not beneath him to do; he sang in praise of their art for, though blind, he could appreciate the beauty of form in their wares. In modern days, not many months ago, the classic eloquence of the Chancellor of the Exchequer, Mr. Gladstone, was called forth by the beauties of pottery and its artistic decoration. In speaking of majolica, we must call to mind the name of Raphael, who thought it not a condescension to devote his talents to the decoration of porcelain, but though his works in majolica were so admirable, the drawing so free and bold, untrammelled by an excess of finish or of colouring, yet the style of majolica was not so faultless as to be copied implicitly in the present day. The entire covering of an object of utility with a picture was not legitimate decoration. When a dessert plate, for instance, was entirely covered with a picture, it could not be used without so disfiguring it with the juice of fruit that it was no longer possible to appreciate its artistic beauties. With regard to the ware termed *Della Robbia*, it consisted of sculptured figures in clay covered with a coloured glaze; and in that known as Palissy ware—the most perfect reproduction of animal forms in pottery—the fish and reptiles in the centre of a dish or plate for soup, were at the time they were made regarded as practical jokes, and so life-like did the great artist, who was also a profound naturalist, make these reproductions, that when covered by a transparent fluid soup the delusion was complete; but now that the idea of their reality was not entertained, the copies and imitations of Palissy ware were of no avail, except as gratifying illustrations of the fact that whatever had been done in ceramic could now be repeated by our enterprising manufacturers. After mentioning the distinguished names of Wedgwood and Minton, of our own time, Mr. Hawkins recurred to the loss which manufacturers had sustained within the last few weeks by the death of Mr. Thomas Battam, who, by the union of practical knowledge with artistic skill and feeling, had done so much for ceramics, more especially for Parian. Mr. Hawkins next spoke of terra-cotta, which, by reason of its durability, afforded so many facilities for out-door decoration. Terra-cotta was first successfully manfactured in this country between the years 1790 and 1800, this enterprise being commenced by a lady of the name of Coade, at Lambeth, but it was for a time superseded by cement. In 1845, the manufacture was again revived by Pulham, of Broxbourne, and by Blanchard and Blashfield, of London. Terra-cotta presented so many advantages in its susceptibility of undercutting and relief after moulding and previous to fixing, and also in its suitability to our climate, being more durable and less affected by weather than even the best stone, that it was a subject for regret that our artists did not make more use of it. There was also another use to which it had been put, viz., as a material for portrait busts. In the South Kensington Museum there were several beautiful ancient busts in terra-cotta; and Mr. Hawkins showed his audience a plaster cast of a terra-cotta bust of Shakespeare, by Roubillac, which was discovered in the pulling down of a building in Lincoln's-inn. It was broken into pieces by the workmen, but after having been re-united by Mr. Clift, was moulded and cast by Mr. Hawkins, while engaged in his great works at the Crystal Palace. This bust presented many difficulties in moulding by reason of the deep undercuts, it being evidently the hand work of the artist, having never been intended for multiplication by casting, and hence the complications in which the modeller had indulged. "Modelling" for terra-cotta might more appropriately be termed carving, for modelling might be defined as putting on what was required, but carving was taking off from the surface and leaving what was required. If the artist, in providing a work for terra-cotta or any other ceramic ware, thoughtlessly added a piece of clay, according to the ordinary process of modelling, that piece would, in the firing, crack or come off. It was therefore a necessary condition for all works leaving the artist's hand direct for the fire that the mass be homogeneous. Works in terra-cotta when moulded, were also divided into pieces for firing, like other ceramic works; the arms, for instance, of a figure were cut off, and the lower limbs also; the artist therefore must, in making a design, take this condition of the material into consideration, and by armlets on the arms, or by the edges of the drapery, aid in the concealment of the inevitable joins. Parian presented the same difficulty, as Mr. Hawkins demonstrated by sketching on his canvass the fourteen pieces into which a small Parian group, called the "Cat's Paw," of a monkey with the cat and chesnuts, which he had himself modelled many years ago, had been cut for moulding. The complexity of the design had thus increased the labour of the moulder—adding to the expense in production. Again, another difficulty of Parian, which was shared only in a slight degree by terra-cotta, was the contraction which took place in the drying and firing of the cast. To illustrate this, Mr. Hawkins had on the table two busts of the Prince of Wales, one in plaster and the other in Parian, both cast from the same mould, though the Parian was one-fourth smaller than the plaster cast. In slender parts, such as the limbs of a figure, the contraction was of course more rapid than that which took place in the bulk of the body. To guard against the possible deformity which this would occasion, the artist had to give additional size to the slender portions, that they might be compensated for, and the contraction become of due proportion with regard to the more solid parts of the figure. These and many other difficulties in material and process, if not known by the artist, would be insuperable obstacles to the reproduction of his works, whereas, if he had a thorough practical knowledge of them, he might so adapt his designs as to facilitate the operations of the workman, and thus that happy co-operation between artist and manufacturer would be secured without which works of art could not be so multiplied and perpetuated in connection with articles of utility as to increase their commercial value, and at the same time reduce the cost of production, so that the masses of the people might become familiar with the refining influence of true art, judiciously combined with the requirements of every-day life.

At the conclusion of the lecture, Mr. Hawes, who occupied the chair, rose, and after remarking on the amount of practical knowledge as well as artistic power which Mr. Waterhouse Hawkins had displayed in his lectures, and in his graphic illustrations on the black canvass, proposed a vote of thanks, which was most heartily responded to by the audience.

Ninth Ordinary Meeting.

Wednesday, February 1st, 1865; Edwin Chadwick, Esq., C.B., in the chair.

The following candidates were proposed for election as members of the Society:—

Cockel, George, 77, Onslow-square, S.W.
Creswick, J. Frost, 8, Bloomsbury-square, W.C.
Evans, George, Newton Heath, Manchester.
Kirkman, C. F., 27, Claremont-terrace, Fentiman's-road, South Lambeth, S.
Mayson, J. S., Rusholme.
Morey, Samuel Dance, Ironmonger-lane, Cheapside, E.C.
Seymour, J. R. W., 23, St. Augustine-road, Camden New-town, N.W.
Telbin, William, 29, Winchester-crescent, Cheyne-walk, Chelsea, S.W.
Tetley, J. Rimington, 21, Carlton-hill, N.W.
Tonge, George, 3, Lancaster-terrace, Upper Hyde Park-gardens, W.

The following candidates were balloted for and duly elected members of the Society:—

Beloe, Chas. H., 26, Bedford-place, Russell-square, W.C.

Bishop, James, 176, Upper Thames-street, E.C.
Bowring, John, 51, St. Mary-axe, E.C.
Dean, John M., The Grove, Stratford, E.
Gibson, John, 1, Stamford-terrace, Stamford-hill, N.
How, Thomas, 29, Gloucester-place, Hyde-park, W.
Hughes, Joseph, 37, Queen-street, Ratcliff, E.
Lavey, Charles, 341, City-road, E.C.
Parker, George Bass, 25, Grove-terrace, Highgate, N., and 4, King-street, Cheapside, E.C.
Paty, General Sir George William, K.C.B., 24, Regent-street, S.W.
Peard, Thomas, 159, High Holborn, W.C.
Pendergast, John, 103, Adelaide-road, N.W.
Pike, Fred., 44, Charing-cross, S.W., and Dulwich, S.E.
Pitman, William, 210, Euston-road, N.W., and 88, Newgate-street, E.C.
Plowden, Trevor Chichell, Oriental Club, S.W.
Plucknett, George, 258, Gray's-inn-road, W.C.
Pratt, Hodgson, 8, Lancaster-terrace, Regent's-pk., N.W.
Rejlander, O. G., 129, Malden-road, N.W.
Robinson, Thomas, 260, Gray's-inn-road, W.C.
Roebuck, William, 21, Ellington-st., Arundel-square, N.
Sconce, Gideon C., 48, Lincoln's-inn-fields, W.C.
Sexton, George, M.D., 63, Springfield-road, St. John's-wood, N.W.
Sharp, Henry Locker, 15, Great Cumberland-street, W.
Shaw, Maltman Wm., 24, Carlton-hill-villas, Camden-road, N.W.
Stanton, John, M.D., 9, Montagu-square, W.
States, William, 12, Prince's-street, Hanover-square, W.
Stevens, Henry, M.D., 78, Grosvenor-street, W.
Stewart, Donald, 7, Gloucester-terrace, Regent's-park, N.W.
Stuart, Charles, Manor-house, Stepney-causeway, E.
Taylor, John Henry, The Limes, Upper Holloway, N., and 15, South-street, Finsbury, E.C.
Teape, Hannaniah, 37, Trinity-square, Tower-hill, E.C.
Thomas, William, 20, Boltons, West Brompton, S.W.
Thorold, Rev. Anthony Wilson, 16, Bedford-square, W.C.
Vickers, Stanley, Hill-house, Streatham-common, S.
Waller, Edmund, 217, Brompton-road, S.W.
West, William Nowell, 30, Montague-street, Russell-square, W.C.
Whytock, Alexander, 9, George-street, Edinburgh.

AND AS HONORARY CORRESPONDING MEMBER.

Honeyman, Rev. D., D.C.L., Antigonish, Nova Scotia.

The following Institutions have been received into Union since the last announcement:—

Dean Mills (near Bolton) Institute.
Newton Heath and Failsworth Mechanics' Institution.
Rusholme Public Hall and Library.

The Paper read was—

LONDON SEWAGE FROM THE AGRICULTURAL POINT OF VIEW.

BY JOHN C. MORTON, ESQ.

I am perfectly aware that any service to be rendered by the Society this evening towards the utilization of London sewage must depend principally upon the discussion which is to follow the reading of this paper. I shall, therefore, not occupy your time for long in stating, as an introduction to this discussion, the data and conditions on which agriculture may be able to offer a solution of the difficulties which surround the subject.

Early last November, before the Metropolitan Board of Works had decided what to do, and while the public papers, stirred up by the report of Lord Robert Montagu's committee, overflowed with controversy on the sewage question, I suggested to your Secretary that advantage should be taken of the agricultural week in December, when many farmers are in town, to submit some of the schemes which had been propounded before that committee to the test of such criticism as they would have received here from an agricultural audience. The Wednesday in question had, however, already been allotted, and that is how the discussion happens to have been delayed till now, and left for me to introduce.

In this paper, then, on "London Sewage from the Agricultural point of view," I not only mean to exclude the engineering and sanitary aspects of the question, but, while discussing the merely agricultural aspect of it, I wish to confine myself and you to that view of it which it presents, not to ratepayers and enthusiasts, but to farmers. Of course everybody knows that there has been a great deal of wild enthusiasm and speculation excited by both newspapers and committees; and even agricultural journals have been "bitten." I suppose that if a sober view of the agricultural value of sewage manure were anywhere to be expected, it would have been in the columns of the *Mark Lane Express*. But what does the clever editor of that agricultural paper say? He declares that recent experiments, discussions, and discoveries have thrown so much new light upon it, and made us all so much more sanguine of a profitable issue, that an altogether new leaf in the book of agricultural progress has, in fact, been turned; and therefore, if any one shall hereafter quote any of the former leaves of this book—any or the older blue books, whether containing evidence of writings of his own or others—in any future discussion of the subject, a vat of the very richest of the stuff is to be prepared, and he is, in short, to be ducked in it.

Now having unfortunately given evidence before Dr. Brady's committee; and having, at intervals during several years, used what opportunities occurred to me of presenting the facts and stating the arguments which have year by year accumulated as the urgency of the question grew, it might thus be difficult for me to avoid the fate which my kind friend and brother editor had prepared for me. In order, therefore, both to escape the ducking, and also to give the most recent evidence of an eye-witness, avoiding all reference to blue books and other publications, I have within the last few weeks spent a day at Rugby, and another at Birmingham, a couple of days at the Craigentinny meadows near Edinburgh, and a couple of days at Croydon. Along with Mr. Harrison, M. Inst. C.E., of Forester Court, Gloucestershire, I have also spent a week in South Essex, down at the Dengie Flats, the Maplin sands, at Burnham, Foulness, Rayleigh, Stanford le-Hope, and other places, trying to find out in what relation the present circumstances of Essex agriculture stand to the subject; and we paid visits to the home farm of the Earl of Essex at Cassiobury, and to Mr. Blackburn's farm at Aldershot. And I propose to-night to tell you what I have seen and heard within the last two months at all these places.

Of course the evidence of an eye-witness accustomed to the inspection of farms and to the examination and discussion of both ordinary and extraordinary agricultural experience, who has made it his business to examine afresh in this way almost all the places where sewage is now being utilised, must be a serviceable contribution to the discussion of the general subject, provided only that it be impartial. And if it be objected, as it may, by advocates of any of the schemes for using London sewage, that anyone who has already committed himself to a particular view of the subject, before, for instance, Dr. Brady's committee, must be pronounced already prejudiced and partial, then it must be at once admitted, that an acquaintance both with agriculture and with sewage had led me long ago to a definite opinion of the right way to connect the two; and that, having formed this opinion after a previous inspection of most of the places named, it was with some confidence in its soundness that I recently examined them again.

This I presume is what is meant by prejudice. Allow me to say that there is no word used by amateurs in agricultural discussions that is more maltreated and abused Any one—I do not say a professional agricultural chemist who works almost as much in the field as in the laboratory,

but a man who takes his facts from the laboratory of the chemist, who deals with soils or with manures on filter papers, in bottles, and in crucibles, or with plants in fragments and in flower-pots, is allowed to expatiate unquestioned, and of course, we all gratefully acknowledge, often usefully upon the policy or impolicy of the various operations of the farm; but he who has witnessed and directed the operations of chemistry and life for years and over acres, who has long annually furnished the material and gathered the fruits of these operations over whole fields and farms, has his doubts or his convictions attributed to prejudice. It seems to me that if the word be properly applicable to whatever either of credulity or of dogmatism on any subject precedes experience, it can be least frequently applicable on agricultural subjects to the farmer. He at least comes to any agricultural discussion with experience to guide opinion; and he has, as I think, cleaner hands, on the score of sobriety and impartiality of judgment, than the enthusiast who charges him with prejudice because he does not believe that the profits of farming depend simply, to put it shortly, upon the atomic theory of the chemist. I at once confess that the analogy of agricultural experience, both of costs and of returns, leads me to prefer those plans for using London sewage by which it is applied to land in quantity, as in water meadows; and I have found that the experience of sewage farmers hitherto does generally sanction these plans. Still further, I may confess that, having investigated pretty fully both at Foulness, Dengie, and the Maplin sands, and through the line of country thither, the plans of Messrs. Napier and Hope for using London Sewage there, I believe them to be consistent both with ordinary agricultural experience and with that of sewage farmers generally. With this "prejudice" it was that I revisited the different places I have named; and now, finally dismissing these personal explanations, it is with this "prejudice" against me, I have to tell you what I saw and heard upon my tour.

1. First then of Rugby:—Here the washings of 8,000 people in a town which is, I understand, very fully supplied with waterclosets, are drained into a tank in the valley below, and thence continually, excepting nights and Sundays, forced by pump through several miles of underground pipage to one or other of various exits, some of them a mile away, on ground probably 60 or 70 feet above the level of the tank; and thence sometimes by hose, and elsewhere by mere surface runnels as in ordinary irrigation, the sewage is distributed, a plot or ridge at a time, over the grass land, until the whole surface of a field is overtaken. I am told £50 a year is paid to the town as rental for the manure—3s. or 4s. a day, or, including expenses of distribution and interest of capital, altogether probably some 30s. to 40s. a day for some 200,000 gallons; and I am told that none of those who rent it are satisfied with the result. Mr. Campbell, to whom a portion of the sewage is sublet, fails of a profitable result because he cannot get the sewage when he wants it, nor enough of it then. Mr. Walker, over whose land most of it is poured, is dissatisfied because of the injured quality of his pasture land, where it has been applied in large quantities. I have seen here heavy and early crops of Italian rye-grass, at least 10 tons per acre, in the month of April, grown on rather unkind land, chiefly by the aid of sewage; and we all know, from the published reports of the experiments superintended by Mr. Lawes, that the produce of the ordinary grass fields upon the lias clay land here has been wonderfully increased by the use of sewage, and nearly in direct proportion to the quantity applied. But it is worth noting that although the manure is here put upon the land at the cost of less than ½d. per ton, and not much more than 1s. per head per annum of the population who supply it, I did not meet with any one who was satisfied that it was agriculturally profitable. Let me mention here two other noteworthy things:—I saw coarse, couchy, weedy-looking stubble of grass, originally, I was told, good grazing ground, which had been sewaged, and which after various mowings had latterly kept an enormous stock on it for some weeks to eat it down. This land had been lately valued for the purposes of ordinary agriculture as having been injured in selling value to the extent, I think, of £20 an acre, by being sewaged. And I saw good grazing land, which had been also sewaged, and was being sewaged when I walked over it—as full of clover and sweet short grass, and as abundantly producing first-class feed as any pasture I was ever over. Both had been sewaged—the one had been mown, and mown, and mown—and the other had been fed, and fed, and fed; the latter kept firm by the treading, and also no doubt replenished by the droppings of the cattle which lay thickly on the ground, had retained the original quality of the grass; which is generally, and at Rugby also as I have said, injured by the sewage irrigation where only mown crops are taken. As to the valuation of the land for ordinary agricultural purposes after a year or two of sewage, it is plain that any figures so obtained must be taken according to their strict meaning. The agricultural valuation of land must be made absolutely, and not for any special purpose, in order to learn whether any profit or loss has been sustained.

2. At Birmingham, the sewers which drain the two valleys over which the houses of 300,000 people are here distributed unite in tanks at the confluence of these valleys, for the settlement and deposit of their mud before the comparatively clear water is allowed to flow into the natural stream again. Some thirty acres of land have been here purchased by the corporation, and this mud is pumped by Walker's diaphragm pump to one and another section of this acreage, and as it dries it is dug out and carried away. This is creating such a nuisance, that at length they are pumping the sediment into barges on the canal within a few hundred yards of the tanks, and taking it to the various farms along the canal; in neither case however does the value received repay the costs connected with the process. In the meantime the soluble and valuable part of Birmingham sewage is going down the river as before. And as the water-closet system extends, both the nuisance of the tanks and the wastefulness of the overflow from them will increase.

The level lands near the tanks are occasionally flooded from the sewers as they were formerly from the river, and with about the same effect as formerly, according to the tenant, who denies the right of the corporation to charge a rent upon him for this water, which is, he alleges, no stronger than the original foul river water.

But it is flat land, and occasionally the water lying on the land has killed the grass instead of benefiting it. This is a contingency which may, I suppose, be occasionally looked for from the washings of a manufacturing town. It will be quoted by the advocates of scanty dressings as a risk to which those who use large quantities are especially liable. It appears to me to have been due to the flat surface, on which, with its imperfect surface drainage, the water must occasionally stagnate. Mr. Councillor Walker is urging the distribution of the overflow of the sewage tanks here, and declares that their 20,000,000 tons of it would, at even ½d. a ton, yield a monstrous revenue beyond the cost of distribution. It seems to me that here is an example of a central delivery of a great town drainage, where the water-closet system must be rapidly extending, which is ready for being turned immediately to agricultural account. It is however fair to mention, that several of the leading medical men in Birmingham recommend cutting off a portion of the supplies from the sewers immediately below the water-closets. Both Dr. Bell Fletcher and Mr. Chesshire, recommend contrivances by which much is retained, as in portable closed cesspools, for collection at monthly or half-yearly intervals by night carts as formerly. And this practice, if it should extend, would to some extent diminish the value of the waste.

3. We now come to the Edinburgh meadows. The

principal facts are that at Lochend and Craigentinny on the north-east, at Grange upon the south, and Dalry upon the west, there are some 350 to 400 acres of grass land, over which the filthy natural drainage of the town is poured as in ordinary water meadows. The lands are generally sloping, so as to enable a rapid flow, and the streams which wash out the valleys over which Edinburgh is spread, receiving the drainage of its houses, are of sufficient volume, when supplemented by the artificial water supply of the city which drains into them, to give an abundant irrigation to the land. From 10,000 to 20,000 tons per acre annually are thus distributed, in one or two floodings during every interval between the cuttings of the grass, of which three, four, and more rarely five, are taken in the course of the season. Perhaps the best illustration of the productiveness and value of the grass thus treated is furnished by the fact that there are about 2,000 cows in and around Edinburgh and Leith fed from these meadows during summer, or nearly six to every acre; and that between the middle of April and the end of October, they will on an average consume from 80 lbs. to 120 lbs. a day apiece, along with about half a bushel daily of spent malt from the distilleries. If the consumption of these cows be put down for 180 days at 100 lbs. apiece, the produce of the acre which keeps six of them must be close on 50 tons a year, and for this the average price paid is £23 to £25, or about 10s. a ton as it grows. I learned from a very intelligent man, who keeps 24 cows in Leith, that he has usually purchased at the spring auctions, when the year's growth is sold, 4 acres for his 24 cows, paying about £100 for them; and this perfectly tallies with the average result already given.

Some of the plots, they say (the grass is let or sold by auction for the year in acre and half-acre plots) are let or sold for as high as £40 the imperial acre, but the average price is £23 to £25 per acre. The worst pieces are the flattest and undrained, which are thus incapable of getting a rapid flow either over or through the land. The best pieces are those which face the south, which have a sufficient slope to permit a rapid flow of the sewage over the surface, and which are of so open a texture as to permit a good natural drainage through the land. It is worth noting too that while the inferior bits have by drainage been improved in productiveness, the best bits always remain the best; it is always particular spots, especially those which, owing to aspect, soil, and abundant supply of irrigation, are earliest ready for the scythe, that command the exceptional prices which are sometimes quoted by enthusiasts as if they were the average yield of the meadows. The early grass is worth to a milkman as much as 1s. per cwt. to go to the field and cut it for himself, although the average throughout the year is not worth much more than 6d., and that is how those early pieces fetch so long a price. It must also be understood that while grass—milk being 10d. a gallon in the Edinburgh trade—is worth 6d. a cwt. or more, perhaps, upon an average, to the cowkeeper to cut and carry a mile, or even two or three, yet it is not worth so much for any other purpose. It will answer for feeding neither cattle, sheep, nor horses; and thus it is that it is just in proportion to the demand there is for it for cows that the price is maintained or not. The prices named were as high twenty years ago as now. There were one-third fewer cows then than now, but there were just about one-third fewer acres then as well. As the demand increased and prices rose, more acres have been added. Italian rye-grass, broken up every third year and re-sown after taking a potato crop, has been grown at Lochend, and lying above the natural fall of the stream, it is watered by a self-acting pump driven by the stream itself; and fetches nearly the average price, although it does not reach the maximum achieved upon the best bits of natural grasses.

At Dalry, too, and the Grange, natural grasses, chiefly rye-grass, have been sown along with, in places, top-dressings of chopped couch, and watered by the foul stream, and equal productiveness has been soon acquired for newly laid down pieces. Whatever grasses are sown originally, *Poa trivialis*, *Alopecurus geniculatus*, and *Glyceria fluitans*, with couch grass, crowfoot, and other weeds, and, where the land is best drained and dryest, rye-grass, catstail, cocksfoot, &c., ultimately form the pasture. And it would be pronounced by any one as I saw it last month, a wonderfully thick and luxuriant grassy surface, nothing like so coarse and weedy generally as the Rugby meadow, to which I have before referred.

At Craigentinny, too, the meadows have been added to occasionally, and pumping engines have been erected to extend the limits of the area commanded by the stream; but they are no longer used, for it has been found here more than once that if but few acres in excess of the demand are brought into the market, the average price of the whole at once drops. I cannot too strongly impress upon promoters of schemes for utilising London sewage, that this is a very important part indeed of the Edinburgh experience for them to read—350 to 400 acres of this sewaged grass suffice for 2,000 cows. The people of Edinburgh and Leith are far better supplied with milk than those of London; but even there there is but one cow to every 100 of the population. And the 30,000 cows required at this rate by the metropolis would all be fed during summer, according to the Edinburgh rate, on 5,000 acres of grass. If there be any considerable increase in the supply of grass here beyond the Edinburgh rate, then it is plain from the Edinburgh experience that the Edinburgh prices will not be realised. Probably, the chief way out of this difficulty may be to copy Lochend in growing Italian rye-grass, for which there is a demand other than that of cow-keepers; but I cannot doubt that the marketing of the enormous grass produce which we shall obtain from London sewage will for many years be the greatest difficulty in the way of a profitable result.

Without discussing here, in detail, the quantity of sewage to which the Edinburgh results are owing, it may be said that the drainage of an area covered by more than 100,000 people is spread over 350 or 400 acres (we cannot, of course, infer from this that the waste from all these people reaches the land); that six to ten floodings are given during the growing season, besides, in the lowest lands, heavy floodings in the winter time—that the duration of the application varies from 4 to 40 hours at a time, and that the quantity applied varies from 10 to 20 thousand tons or more per acre in the year—that the grass produced is 45 to 50 tons per acre, capable of feeding 6 cows during the summer half-year; and that it is bought by men who are at all the expense of cutting it and carrying it home themselves for £23 to £25 per acre on an average, exceeding £35 and even £40 per acre in particular and exceptional plots. It may be also said that much of the land yielding nearly the average price is the poorest seaside sand; and that a great deal of it, watered with tail water which has already gone over land above, is just as good as the rest. It is all mowed and mowed, the produce being carried wholly away, and it maintains its productiveness year by year under this abundant sewage irrigation, notwithstanding this immense draught upon its resources. One fact more of great importance,—the poor, sandy land, notwithstanding the immense supplies of manure, is not enriched; a grain crop following the heaviest crop of grass, being unmanured, has failed; the potatoes following the Italian rye-grass at Lochend require to be most liberally manured. The Italian rye-grass following last year's manured potatoes, sown in August and September, was looking splendidly last month at Lochend, and dressed as it will soon be with sewage, it will be worth, perhaps, £20 an acre during the coming summer. In 1866 it may be worth as much, but this growth and value is wholly owing to the supply month by month of the manure, not at all to the land, which is no richer at the end of all this manuring than it was at the beginning.

So much for the Edinburgh meadows. If the net gross proceeds of the land be put down as £8,000, there is

probably as much as 2s. a head obtained from so many of the population as contribute to the result, and diluted as it is (much of it, too, used twice), I do not suppose that more than ¾d. per ton is obtained from the sewage. The Edinburgh results are obtained from the use of very dilute and already putrifying sewage in large quantities over slopes of light and well-drained land. And poor though they be as compared with the results and definitions of analysis, they are the most profitable results that have yet been anywhere obtained.

4. Compare them with those on farms near London.

(*a*) Near Croydon, Mr. Marriage deals with the sewage of 20,000 people, in a stream of 1,000,000 gallons daily, over an extent of about 250 acres. He uses the water a second or third time. His fields vary from 300 to 500 yards long. The feeders are 15 yards apart, and the "panes" or beds between them sink transversely at once from these parallel feeders across the breadth of them; and they sink, on the whole, in the length of them, about 1 in 400. There are no intervening drains, but any cubic inch of sewage may leave the feeder at the upper end, and, if not previously absorbed by the gravel subsoil, may trickle over the whole length of the bed to the transverse drain across it, 400 yards off; or it may leave the feeder 10 yards from the end, trickling only 10 or 15 yards to the drain close by. A very close and thick growth of grass, with clover appearing in the autumn, exists in the upper fields of natural pasture, which has come of itself after the Italian rye-grass without any direct sowing of seed, when the latter had died out, as it gradually does, after the second or third year. Italian rye-grass is sown in autumn, and keeps down two or three years, and is then broken up for mangel-wurzel and followed by potatoes, and then is sown down again. A cutting of 10 or 12 tons of grass in May is followed by others of about 7, 4, and 3 or 4 respectively, so that upwards of 20 and up to 25 tons of green food are got for sale. This, however, is certainly less than might be expected. Mr. Marriage declares that there is no good derived from drainage; mere surface feeding as it flows is depended on; but the gravel subsoil here does supply a natural drainage to a certain extent, and the ditches are deep enough to take advantage of it. Land in the neighbourhood, and this land before sewaging, was worth £2 an acre; Mr. Marriage pays £5 and seemed in good spirits. He gets, I believe, upwards of 20s. a ton for grass in town 10 miles off, and 12s. to 14s. a ton for it on the ground, his own men mowing it and weighing it. Sewage helps the early growth amazingly. It is common to put it on twice between the cuttings, the intervals being five or six weeks, and the latter of the two dressings being often among the tall grass, when it is quite as efficient as elsewhere. It is put on for 30 hours at a time. The main facts are that the sewage all goes on filthy, and leaves the farm clean and limpid; and mixing up Mr. Marriage's plans for the future with his experience in the past, we may believe that it will leave behind it on the 250 acres available for it the following produce:—150 acres of Italian rye-grass at 20 tons = 3,000 tons at 12s. = £1,800; 50 acres of mangel wurzel at 20 tons = 1,000 tons at 20s. = £1,000; 50 acres of potatoes at 6 tons = 300 tons at 70s. = £1,050 = in all (under a rotation of three years, Italian rye-grass, mangel-wurzel, and potatoes) £3,850, or about £15 per acre. It is plain that this sum may be largely raised by an increase in the quantity of the Italian rye-grass; and this, I cannot doubt, must be obtainable. It is only gradually that a market has been obtained for the grass. At first there was considerable difficulty and some hay-making. Now there is a constant demand, but only an uneven supply. The second and third cuttings last year suffered from the drought, and under a hot summer sun it seemed that the tendency of the grass to throw up its seed-stem was unconquerable.

(*b*) At Cassiobury, the experience of the Earl of Essex, which is longer than that realised at Croydon, may be also named. There is here, from Watford, the sewage of 4,000 people, and 200 acres of land were provided with pipage to receive it; but I understand that his lordship has learned by experience of its comparatively small value in small quantities, to apply the whole of it over only 7 or 8 acres of Italian rye-grass during summer, cutting 30 or 40 tons per acre annually, and throwing it over 30 to 40 acres of his park land during winter.

(*c*) Mention must be made of the Camp Farm, Aldershot. 10,000 to 12,000 men use the latrines. These are flooded and flushed out at regular intervals, and the whole of the stuff is to come through 18-inch pipes of earthenware down to Mr. Blackburn's farm. This is 160 acres of poor gravelly, sandy, heathery waste. The subject here is only in estimate and anticipation as yet, although Mr. Blackburn has had experience elsewhere, by which he is guided both as to plans and expectations. Some of the stuff will *flow* over part of this land, and that part will always be available for the overflow of any remainder, which is undelivered by the pumping apparatus. Mr. Blackburn will pump by underground pipes to the centre of every five acres, and thence deliver through surface-pipes on wheels, to the centre of every 1½ acre, and thence by hose. A man will thus deliver, it is said, 400 tons a day, and 200 tons are expected to be a dressing for an acre. Drainage is obtained naturally through a gravel subsoil, and it is intended that none of the sewage shall flow off the surface; it shall all be used in the deepened soil, and it shall all be used on a minimum quantity of land in the first place, until that is got up to the right standard of fertility, and then the work will be extended. Italian rye-grass will be followed every third year by potatoes. Sixty tons per acre of the grass is the produce to be aimed at, and some 20 acres only are in the meantime being prepared. The plan here is to put the sewage on before it has time to rot, and to use it by hose and jet at the rate of 200 to 400 tons to a cutting. There is a quantity of water in land springs available, and useful for irrigation; but ordinary surface irrigation is not the plan advocated by Mr. Blackburn; he holds that only as a second resource. It is with pipe and hose, and with an economical use of the fresh material, that he declares to win.

It is plain that Mr. Blackburn's plans are directly opposed to those which have been productive of the Edinburgh result, which is due to irrigation in quantity with dilute and putrid sewage, and to a feeding not of the soil but of the plant.

These, then, are the facts, wholly agricultural—for I have not referred to the chemistry of the subject at all—on which the agricultural view of London sewage depends. The sewage of London differs from that of Rugby, Edinburgh, and Croydon in quantity alone. In every case there are from 40 to 60 tons of water to the annual waste of every individual of the population. In every case, as water-closets come more generally into operation, this filthy water will become more fertilising. Meanwhile, the actual agricultural experience elsewhere surely is the proper guide for estimate and foresight here. If we had 15,000 to 20,000 acres of light and sandy slopes below the present outfall of the sewers, this agricultural experience would point at once to a very easy solution of the problem. Failing these, Messrs. Napier and Hope propose to pump the whole of North London sewage (100,000,000 tons per annum) 50 or 60 feet, and let it flow along a culvert down to Foulness and the Maplin sands, where some thousands of acres, partly perhaps by purchase and partly by embankment from the sea, can be obtained, over which it may be poured, and there produce the 40 to 50 tons of grass per acre which are got at Craigentinny. This will be the almost immediate result; and thereafter year by year, on the farms along the course of the culvert, it is believed a demand for sewage will gradually arise to supplement the deficiencies of Essex agriculture. I suppose that in the immediate opportunity which is thus afforded of using all the sewage at the very outset, whether or not in an outrageously extravagant and wasteful way, as some people think (at all events very

much after the way in which Craigentinny is at present managed), combining with this the scope which is afforded for the gradual extension of a more economical and considerate use of the sewage all through the lower part of Essex, on its way to the final outfall, this scheme has the advantage of its rivals. It certainly has the sanction of the agricultural view of the subject which Rugby, Edinburgh, Croydon, and Cassiobury present; and while Aldershot, with its proposed economy of the material, is still a problem, yet, if that should succeed, it too may be copied easily and perfectly.

I propose now to devote the short remainder of this paper to a consideration of the scope which Essex agriculture, on the one hand along the line of the culvert, and the Maplin Sands on the other, at the termination of the culvert, offers for the use of London sewage.

The Maplin Sands, a considerable width of which it is proposed to embank, are a uniform slope of sheer sand, not sufficiently inclined for catch-water irrigation, but sloped probably enough for the ridge line feeders of "lands" extending seawards at right angles from the shore; which lands might be laid out with sides sufficiently steep and with intervening drains also having fall enough; and several series of such lands, 300 or 400 yards long apiece, all pointing seawards, might be laid out in the breadth reclaimed; the cross main-drains of the first series collecting the water used there for a second use over the third series, and the tail water of the second series being used upon the fourth, and so on. The island of Foulness, on the side next the sand, all below high-water mark, is a comparatively light soil, and in places shallow, upon a sandy subsoil, quite suitable for irrigation, and capable of being laid out for it without much expense.

Excepting about Rochford and the Wakerings, and again over a tract near Stanford-le-Hope, where the soil is more or less free and light over gravel, the land all along South Essex, westward from Foulness, is a stiff clay soil. Most of it is arable—a proof of dry climate. Anywhere else than Essex such land would be in pasture, and if ever the rainfall be supplemented by even so small a quantity as 12 to 20 inches of sewage annually, it must be pasture here. Such stiff clay would be utterly unmanageable as plough land if frequently soaked either naturally or artificially. The drainage of the country is almost wholly a surface drainage: narrow ridges, the width of harrow, drill, &c., are worked by horses walking in the furrows, and these furrows are immediately cleaned out by a plough following the sowing machine, and they are then connected by cross-cut furrows cleaned out by hand where necessary. Steam cultivation has been adopted in places, and probably deep draining will succeed after it. It is wheat and bean land, with occasional vetches and fallow; straw is sold into London and dung brought back at about the cost of the straw. The whole country is London-clay and arable, growing corn and straw for sale, and buying dung. There is hardly any stock to be seen. And on Foulness the sales of straw to the bargemen and purchases of manure from the bargemen about balance each other in the year.

It seems to me that in the barren slope of worthless sand at one end of the line, in the immense scope which exists for an extension of the milk supply, of which I hope we shall hear something more this evening, at the other end of the line, and in the existence of an extensive tract of arable land without stock, whose straw is at present sent 20, 30, and 40 miles, manure being brought back as far, we have all the elements required for the profitable conversion of 100,000,000 tons per annum of North London sewage.

At the outset probably the demand for sewage along the line must not be counted on. But, then, these sands come into use. In the outset, too, we shall probably be over-stocked with the produce of the grass sown there; and hay-making may be required. Of course it is impossible to make 30 or 40 tons of grass per acre into hay while the sun shines upon the land which grows so much. But I think it may be possible to make it artificially. Twenty-five tons of well-grown Italian rye-grass, which may make only £12 or £13 as green food, will yield probably 5 tons of hay, worth at least £20. In the manufacture of this quantity 20 tons of water must be driven off, and if this can be done for £6 or £7, there will be a profit on the process. The grass might pass downwards by zigzag travelling open bands or shakers, from the top of a shaft or building to which it had been lifted, and might during its passage downwards be subjected to a current of hot dry air upwards, so as to come out dry enough to stack; or it might be taken slowly along a long horizontal shaft, and subjected to the same influence, entering it green and emerging dry. There does not seem any difficulty on the face of it in thus dealing with that large surplus of green grass, which will certainly in the first instance be on hand. And if 6 or 7 tons of hay per acre are thus obtainable, the revenue should be even larger than if a direct sale were had for grass at 10s. a ton.

The books tell us that 6 to 10 grains of water would be taken up in every 100 cubic inches of space, raised from say 60° to 180° or 200°, even supposing it saturated at the lower temperature. To take up 20 tons of water in this way then, we should need a space equal to from two to three millions of cubic feet, and raise its temperature from 60° to 180° or 200°, and keep it (or, what is the same thing, keep so much air) at that temperature while it was passing through a shaft or passage for long enough to get saturated at the higher temperature from the moisture of the green grass as that was being brought along the passage. Can such a shaft or passage, say 4 feet deep and 10 feet wide, be kept at the temperature in question, and have air heated to that temperature driven along it at the rate of about 800 yards an hour for 24 hours, by the consumption of say five tons of coal? If it can, then hay can be artificially made at a profit. And although the sewaged natural grass makes soft and worthless hay, that from Italian rye-grass is perfectly good. The conversion of the green grass into hay, is a change from goods for which there is insufficient market, and which will spoil if not immediately used, to goods for which there is always a demand, and which can be stored. And believing, as I do, that the immediate effect of any great extension, in the neighbourhood of London, of such an experience as that of Lochend or Craigentinny, or even that of Croydon (the only profitable examples by the way which we have to follow) would at once glut the market, and altogether overflow the demand for its produce, I feel certain that this question of artificial hay-making is of great importance.

Whatever the scheme adopted, there is no difficulty either on the score of engineering, or, where the abundant method of irrigation is adopted, on the score of the chemistry and composition of the material, to be anticipated. Neither is there any difficulty in the agricultural aspect of it, so far as the certainty of a crop is concerned; but I believe that during the first years of our agricultural experience of it, we shall be puzzled by a plethora of produce, for which there will be an insufficient market. It will be some time before the cow-keeping business will be transplanted from the grooves in which both food and trade have run so long, down to a new region, though it be of food so much more cheap and plentiful, and the question of artificial haymaking will have considerable importance during the period of change.

There is, however, another opportunity of a market afforded by the circumstances of South Essex agriculture.

Almost the whole of south-east Essex is arable, growing corn and straw for London, and fertilized by London dung, often at about the cost of the straw sold. There is, you may say, no stock. It is probable that if grass were supplied to the farmers here they would consume it in yards at home, and send milk or meat to London, making manure for themselves, rather than, at great labour and expense, send straw to London, and cart back the dung. And this, if it could be carried out, would be the best

way of disposing of the produce of the sewaged lands. The grass would be sold, if cheap enough, more easily than the sewage; and if it can be carried for 1d. or 2d. per ton per mile, I believe it can be delivered cheap enough to tempt a trade.

Green food properly consumed is worth 6s. to 9s. a ton to feed upon the land even in ordinary agriculture; near London, with a ready and immediate disposal of milk, it is worth from 15s. up to 20s. a ton. It is hardly possible to doubt either that cowhouses on a large scale, well situated near depôts of grass in a country where there is a great demand for dung, and an ample supply of straw, and where winter food may easily be grown—with ready access, too, to the London milk market, would at once be hired and worked; or that under such circumstances a considerable change in the style of agriculture of the district would gradually grow; more stock would be kept upon the farms, and the London milk trade would extend over the plough lands of South Essex.

Moreover, there is the opportunity offered to the tenants of all such lands as lie near the culvert, to use the sewage on their own lands and grow this grass themselves. I presume it is part of any and every plan of using the 2 or 300,000,000 tons per annum of London sewage to pump it into reservoirs on hill tops or rising ground wherever a local demand for its use occurs. Thence it may be delivered by hydrants or in runnels on the surface of the fields to be watered. I confess my strong preference of the latter to the former plan. There is all the difference between them that exists between labour-needing and self-acting machinery; and while it is of course thus distributed more cheaply, it may be also quite as economical in the use of the material. If I had only 10,000 tons of the stuff per annum to pour over 10 acres on a slope, (and this would, I presume, be thought a reasonable allowance even by those who advocate small dressings), I should prefer pouring it all over the highest acre, letting its tail water reach the others in succession by ordinary surface flow, to an equable distribution over the whole from equidistant hydrants, each of which must be managed by hand, delivering no more at a time than would sink into the land and there be all used. If, however, occasional reservoirs existed whence this sewage could be available in either way in different localities, we might safely leave those who have to make a profit by its use to their own devices as to its management. Anyhow, if by the use of surface irrigation great crops are obtained, and the water at a second or third use is perfectly clarified, then it is plain that the whole attainable result is arrived at; and great expense in hydrants and in detailed distribution will in that case be an expenditure for no useful end.

I believe I have only one additional remark to make, and that hinges on the conclusion here asserted—that if the water leave the land perfectly clarified, the whole attainable result is reached. This will be at once disputed, and is perhaps not absolutely true. In a dry season, no doubt, water, though free from fertilising matter, is itself invaluable, and in a drought it would often pay for pumping and for distribution; but when there is a question of gradually altering the whole style of agriculture of a county, I do not believe in this extra value of the mere water by which enthusiasts, in the advocacy of particular schemes, add on so many additional thousands of pounds to their anticipated receipts.

We have in this country varieties of rainfall amounting to 3,000 and 4,000 tons of water per acre per annum, but the value of the land depends very little upon this. The various styles of agriculture resulting from these differing circumstances do not, as a rule, differ materially in the quantity of rent which is possible under each. That depends on the composition and quality of the land; on the cheapness or abundance of manure, and on the neighbourhood of good markets.

On this subject, however, I must not longer detain you, and I will conclude by naming the results to which this discussion of the subject has hitherto led.

Collecting these nearly into one, although I have not been able to overtake, within the allotted time, all the grounds on which an opinion must be formed, yet the conclusion to which I believe that the agriculturist is led after a study of the subject, is, that grass as the produce and ordinary irrigation as the method—both as involving a minimum of labour—are the proper agents by which the conversion, which we all desire, of London sewage into London milk will most profitably be obtained.

Certainly, on the clay lands of South Essex, to double or quadruple the present annual water supply by a sufficient application of this sewage would be altogether incompatible with anything but grass. On lighter lands with natural drainage, as perhaps ultimately on the Maplin Sands, it may be possible to use the liquid in the growth of mangel-wurzel or potatoes, and to take under arable management one or other of these crops in triennial succession with Italian rye-grass, but elsewhere it must be grass, and only grass, that is capable of sewage treatment.

Another principal conclusion is, that the profitable conversion of the enormous addition to the grass growth of South Essex, which will follow the use of London sewage, can be expected only through a great and therefore necessarily a gradual extension of the London milk trade.

According to Mr. Lawes, we can depend on a ton of grass from every 200 tons or thereabouts of the sewage; and to this agrees the experience at Edinburgh. What if some 200,000,000 tons, taking both north and south London sewage, be annually converted by-and-bye into grass, which, according to the Craigentinny rule, is good for hardly anything but cow food. We should every summer have a million tons of grass to eat—enough for 50,000 cows, in addition to the supplies already grown for the number by which London milk at present is provided.

Lastly, then, as a help out of this—one of the main difficulties which threaten the immediate profitableness of any scheme for using London sewage—I hope that experiments may be instituted as to the possibility of artificial hay making.

It will have been observed that in the course of this paper I have made no reference to Mr. Moule's earth system of dealing with house waste, or to any other of the schemes of dealing with it in detail. The reason is, that I am constrained by the terms in which the subject is announced. The subject is London Sewage, and we are therefore shut up to a discussion of the question—how to use 200,000,000 or 300,000,000 tons of filthy water annually upon the land. That is the problem for consideration; and thus the discussion of methods fit for single houses, or for villages, is excluded.

Again, I have made no reference to the nuisance which may be expected from that agricultural use of this sewage that experience elsewhere seems to have recommended. I believe that the efficacy of the sewage as a manure will be dependent, to some extent, on its being already in a putrifying state; and no doubt a certain nuisance will be created. But if any alarmist here, ready charged with a denunciation of these plans on this account, be about to frighten us all with accounts either of putrid miasma and resultant fevers, or of new parasitic enemies, which through rotten sewage, rank and filthy grass, unhealthy cows and unwholesome milk, are thus to find their home in our bodies, breeding there disease and death, I hope that he and all of us will bear in mind that 400 acres of land, treated more wastefully and filthily than any of the London schemes propose, have been for a century and more under the very noses of the Edinburgh people; who have, moreover, been fed for generations on the milk of the cows which have consumed this sewaged grass. If any evils of the kind alleged are in the least to be expected, they must long ago have shown themselves in the death rate of so large a town; which, how-

ever, I believe, stands as low as that of any in the country. Lastly, it will, of course, be pointed out that I have named one only of the rival schemes for using London sewage. In choosing that one of the number for any particular application of those rules of practice and experience to which I have been calling your attention, I have followed the example of the shrewd and intelligent representatives of London who constitute the Metropolitan Board of Works They, too, have followed the plans of Messrs. Napier and Hope, as being most worthy of adoption, and they cannot be supposed indifferent either to the general interest of Londoners or to the special interest of those among them who are ratepayers. It is plain, however, that in so far as the experience which has been described sanctions any other of the schemes which have been propounded, most of the remarks which I have made may be quoted by the advocates of those with equal effect.

DISCUSSION.

Mr. Henry Webber said, through the kindness of Dr. Lankester, he was able to bring before the meeting some specimens of the sewage water of London, taken from the Barking outfall. Having been resident in Manchester for thirteen years previous to 1856, and his business (that of a cheese factor) having brought him into communication with farmers, he had seen the most astonishing results from the utilisation of sewage. He might mention one case in particular within his own knowledge, in which the area of grass land was barely sufficient for the maintenance of seventeen cows, the average yield of which was $2\frac{1}{2}$ cwt. of cheese per annum, and the same area of land was, by the application of sewage, made capable of supporting 47 cows, the average yield of which was $3\frac{1}{2}$ cwt. of cheese per annum each. This was sufficient, he thought, to show the great fertilising property of the sewage. Notwithstanding the great practical knowledge of Mr. Morton on this subject, there were some conclusions which that gentleman had drawn with which he (Mr. Webber) could not concur. The proposal to carry the sewage into Essex had been favourably spoken of in the paper, a county which, as the names of many of its towns implied, had only just freed itself from water. It was proposed to carry 100,000,000 gallons of sewage water annually to Ilford, Romford, Chelmsford, and through marshes where the division of land was not by hedges but by water, and by that means to bring that part of the country back again to the state from which it had only just been freed, and which had operated prejudicially upon the productiveness of the land, viz., excessive moisture. The question then arose, in which direction could they beneficially employ this sewage? To that he replied, they had only to cross the Thames and go into the county of Surrey, where they would find a dry parched soil, much better suited for the application of the sewage, which would convert that which was now almost an arid sand into good fertile soil. He had travelled hundreds of miles over the plains of America, and he had not seen anything so sterile there as was to be met with in the neighbourhood of Woking and the Frimley ranges. He believed to take the sewage into Essex would be a failure, and the result of that failure would be to set aside, for centuries, perhaps, any further attempts to give an agricultural value to this product. It should rather be taken where the soil needed it—to the dry and sterile soil of Surrey, where they might look for the very best results from such an application.

Mr. Walker (of Rugby) said that the extensive pollution of an otherwise beautiful stream in the locality in which he resided induced him, 12 or 13 years ago, to turn his attention to the question of how best to apply the sewage of towns to the land, and from that time to the present he had been more or less occupied in the endeavour to solve this problem, and he had great pleasure in stating that he believed he had at length succeeded in doing so. He had heard all sorts of enthusiasts crying sewage up and others crying it down, both going equally far from the truth, till at length the happy medium, he believed, had been arrived at. But there were some points on which he thought there was still a slight diversity of opinion. Mr. Morton had told them that almost the only way of applying the sewage was by the creation of water meadows. He (Mr. Walker) thought it was probably the best way, but it was by no means the only profitable application of it. In many cases this was undesirable. The object of his experiments at Rugby had been to endeavour to utilise the sewage mainly on pasture land, and, in some measure, upon cereal crops; and he considered what had been done at that place was sufficient to show that sewage could be applied very profitably on good pasture land, without deterioration either to the crops or to the land, and also without producing a nuisance. He thought Mr. Morton had in some measure answered his own arguments on that point, for he had pointed out how difficult it was with the produce of water meadows—only suitable for feeding cows—to obtain a market for the grass if cut, and that was in itself a serious difficulty. For instance, at Rugby, if all the sewage were turned upon the water meadows, the town could not consume the produce of the cows required to feed off the grass, though if it could be artificially converted into hay by the ingenious plan suggested by Mr. Morton, that might remove the difficulty; but at present, however, in small towns it was insuperable under existing arrangements. Therefore, it was of importance to have experiments to show that sewage might be profitably employed on flat pastures, and that he conceived had already been shown at Rugby. Mr. Morton had stated that some of the land there had been completely spoiled. That was quite correct. Land more shamefully spoiled he had never seen than that under the operations of the Royal Sewage Commission. Mr. Morton also mentioned that he had seen other land in the same neighbourhood sewaged and fed off, which was most excellent turf, full of fine grass. That land had to his (Mr. Walker's) knowledge been fed for the last twelve years. There was very little land in fact that had been more continuously watered, but it was not spoilt, because the crop was kept down by feeding; and he maintained, whether it was kept down by the scythe or by the mouths of animals was immaterial; it must, however, be kept down. Directly grass which was watered was allowed to run wild it became coarse, and when the fine grass was destroyed it could not be restored without re-sowing. The great point, then, was, whatever quality of sewage they put upon the land, to take care that the herbage did not run away. It was precisely the same with the trees in a shrubbery. If there were means of stimulating the growth of the trees five-fold, and they were neglected for four or five years, the plantation would become a tangled jungle. So it was with these pastures; and that was the history of the great part of the failure at Rugby. It was obvious that in many towns there were great objections to creating water meadows, which sometimes became, more or less, a nuisance in the neighbourhood; and, therefore, it was, if the system of improving the pastures by moderate watering would be efficacious, that would, in most cases, be the best means of utilising the sewage. The quantity used years ago, however, was far too small to do good. At one time they talked of 5,000 gallons per acre. That was the quantity recommended in the first report of the Board of Health; now they heard of 6,000, 8,000, and 10,000 tons per acre. His impression was, as far as he had seen, that if they mowed or fed the crops carefully they might produce enormous crops with 750 tons per acre spread over five dressings during the year. Supposing, however, they wanted simply to make the most of a given quantity of sewage, if the mode of applying it was necessarily expensive, then they might limit the area and increase the quantity per acre, and, within certain limits, *vice versâ*. Rugby had been constantly mentioned as an instance of failure, and more so lately from the grievous failure in one sense of the ex-

periments of the Royal Commissioners. Four years ago two of his own fields were arranged in plots for experiment; these plots were severally watered in different degrees, one plot not being watered at all. That portion which they watered extravagantly, drowning it at one time and allowing it to become parched up at another, produced very largely at first, but afterwards the grass became very poor. The next plot, which was only less drowned, was slightly less productive, because the parching process had greater prominence; while a third plot, more parched than drowned, produced still less. Such a mode of application was the cause of the want of success of the experiments of the Commission. It was mentioned in the paper that Mr. Campbell, who rented some land of his, had applied a portion of sewage to that land; but the fact was, that gentleman's land all lay so high that he could get only a small proportion of sewage, as the surrounding country was at a lower level. The arrangement for supplying Mr. Campbell was made at the time when it was supposed that a very small quantity of sewage was sufficient; but now it was shown not to be so. He had two other tenants of land who had also declared themselves dissatisfied with the results of sewage irrigation, but in their cases he did not hesitate to say that the failures were occasioned solely by mismanagement. Moreover, when this plan was first commenced, only the sewage proper was allowed to go down the drains of the town; but the pipes were so laid that they very soon became choked, and the surface water of the district was employed to flush the sewers out. The consequence was, in dry weather, these surface drains had no effect. Last summer there was not water enough to keep the pumps at work, and in heavy rains they were drowned out; and with but a small amount of rain there was so great a dilution that the effect of the sewage was very greatly deteriorated. Still he was not less confident than he had ever been that the sewage of towns might be profitably employed to irrigate flat meadows, and he believed also to enrich land for cereal crops. If it was to be done at all, it should be by saturating the ground time after time, allowing it to dry to a reasonable extent before the growing crop was upon it. He would make one other remark with regard to the outfall for London sewage. He thought it to be regretted that the money which was being spent in collecting the sewage at Erith was not spent in erecting a system of steam engines and pipes for collecting it at different points, and making it radiate in various directions—north, east, south, and west; but, as this error had been committed, he thought the scheme for utilising the sewage in Essex was the best thing that could be done with it.

The Chairman asked, supposing Mr. Walker had to begin the system at Rugby again, what area would he consider sufficient for utilising the sewage of that town?

Mr. Walker replied he should be disposed to lay pipes nearly to the same extent as he had done already, but they would not be strictly necessary. He could utilise the sewage over a much smaller area, and if the object were to get rid of the sewage, one-tenth of the present area would be quite sufficient for the purpose.

Lord Robert Montagu, M.P., begged to bear his testimony to the merits of Mr. Morton's paper. He trusted he should not be deemed guilty of presumption in venturing to state a few points on which he differed even from so high an authority on these matters as Mr. Morton. That gentleman, in an early part of his paper, made use of this expression—"I at once confess that the analogy of agricultural experience, both of costs and of returns, leads me to prefer those plans for using London sewage by which it is applied to land in quantity." Now he (Lord R. Montagu) was at a loss to know what those analogies in agricultural experience might be. When they put farm-yard manure upon the land, did they put it on in unlimited quantities? Did they not put it on rather sparingly? Did not the farmer carefully calculate how much manure the extra crops produced would pay for? and no more than than would be put on his land. In like manner, if he used guano, he would carefully regulate the quantity. The rule laid down by Professor Way was that they should only put as much manure on the land as it would readily absorb. The power of land to absorb was extremely limited. If they put more sewage on the land than it could absorb it ran through the land, did not enrich it, but, on the contrary, injured it, and the sewage that ran off entered the streams in the neighbourhood, and the health of the population was thereby endangered. But what was the reason Mr. Lawes gave for putting these large quantities of sewage on the land? He merely did so, he said, to get rid of it—not to get larger crops. The speaker having quoted from Mr. Lawes's evidence on this point, went on to observe that the only reason Mr. Lawes gave for putting this unlimited amount of sewage on the land, was to get rid of the sewage. At Croydon, when they commenced utilising the sewage they began with a small area. They found it occasionally a nuisance; the mud deposited on the land became putrid. They enlarged the area from 56 acres to 100 acres, still it was too small; and they then enlarged it to 260 acres, to which they were restricted by an unfortunate contract they entered into; but they would have been glad to have increased the acreage. Mr. Morton seemed to have been somewhat aware of the mistake he had made in the earlier part of the paper; for he said that Mr. Blackburn, who was the person who employed the sewage at Aldershot, applied only between 200 and 400 tons per acre per annum. If that were good, what must they think of a gentlemen who, in his evidence before the Parliamentary Committee, said he would put on 50,000, 60,000, and even 70,000 tons per acre. That would be equal to a rainfall of the depth of the room in which they were assembled.

The Chairman remarked that he believed Mr. Blackburn's work had been only recently commenced—three months ago—so that there must be some mistake as to any annual amount he had been said to have applied to the land.

Lord R. Montagu—From Mr. Blackburn Mr. Morton passed on to Mr. Walker (of Rugby), who gave excellent evidence before the Committee. It was said that Mr. Walker was dissatisfied because of the injured quality of his land, the alleged deterioration being to the extent of £20 per acre. That truly was the evidence of Mr. Walker with regard to that part of the land over which Mr. Lawes applied the sewage; but a part of the land had remained in his own hands, and that did not pay him; but if he rightly understood the evidence of that gentleman as well as that of others, it was because he had patriotically gone to a large expense in erecting engines and laying down pipes, and by that means diminished his profits. He now came to that portion of the land over which Mr. Lawes had applied the sewage, which was three acres in extent. Mr. Morton said not only was it wrong from the quantity of sewage put on it, but also from the precise rules which were laid down by Mr. Lawes himself, viz., that at such and such times the sewage was to be applied, and at certain precise periods the grass was to be cut. The grass grew long and rank, and rotted at the roots, but Mr. Lawes did not cut it because the prescribed time had not arrived. At last the haymaking time came, and the grass was cut and carted away, while the rotted roots were left to bake in the hot summer sun, the land was parched and cracked, and all the grass worth having was killed. Mr. Morton was perfectly right in saying that he only saw coarse, couchy, weedy stubble of grass. What else could be expected on land at one time drenched with moisture and at another time baked by the heat. Mr. Napier and Mr. Hope stated in their evidence that the Rugby experiment was no criterion at all; and they trusted at least that their own experiment, if ever it was carried out, would be more successful than that of Mr. Lawes. He hoped the same

thing. In another passage of his paper Mr. Morton stated that Mr. Lawes's experiments showed that the crops were increased in direct proportion to the quantity of sewage applied to the land. He would again call to their mind the rule of Professor Way—that they could only successfully apply so much sewage as the earth could absorb, and that which ran away from the land was sheer waste. Professor Way stated further, that the colouring matter in the sewage was due to certain fertilising elements in suspension in it; but so many of these were soluble, that if water apparently pure ran off the land it was no proof that none of them were carried away along with it. If it passed away in a coloured state, *à fortiori*, some of the fertilising elements were carried away. With regard to Rugby, Mr. Lawes stated that the sewage which ran away through the drains was highly coloured. That proved that he put on so much that a great deal of it never reached the roots of the crops at all? The results of the experiment of increasing the quantity of sewage were these:—On the unsewaged land the crop of grass was nine tons per acre; with 3,000 tons of sewage the produce was twenty-two tons; with double that amount of sewage the produce was only one-third more; with 9,000 tons of sewage only one-fifteenth more; which showed that the crop was not increased in proportion to the quantity of sewage applied. It might naturally be asked what was the result with a smaller quantity than 3,000 tons, but this experiment Mr. Lawes had not tried. But there were other witnesses before the committee, such as Mr. Mechi, who used only a small quantity of sewage. Mr. Walker had stated this evening he would not apply, on an average, more than 750 tons per acre; nevertheless Mr. Lawes asserted that he would go even to the extent of 70,000 tons an acre. Mr. Morton had stated that he had not met with any one who was satisfied that the application of sewage to the land was agriculturally profitable. He imagined that sentence of the paper applied to Rugby alone; but he thought they had altogether disposed of Rugby, inasmuch as Mr. Walker stated that the experiments there proved nothing. Mr. Morton had alluded to Edinburgh, but there were a few matters he had left out. The application of the sewage at Edinburgh was desscribed by Mr. Rawlinson, and Professor Way, and he believed by Mr. Hope also, as clumsy and bad, and the waste of manure was enormous. But what were the agricultural advantages even under that acknowledged imperfect method? In the autumn of last year he visited the Craigentinny meadows. The sixth crop had then been cut, and the seventh was on the field knee deep. He was told that formerly that land had let at 2s. 6d. per acre, and was now bringing £40 per acre. Coming back again to Croydon, the sewage of a population of 17,000, amounting to nearly a million gallons per day, used to flow into the Wandle. Numerous actions were brought against the Local Board for the damage thereby done to the stream; amongst other complaints was that of the fish in it being destroyed. No fewer than seven actions and injunctions were tried, at a cost to the Croydon Board of some £10,000. Vice-Chancellor Wood, on the authority of various scientific witnesses, declared that it was necessary to apply the sewage to the land before it should be allowed to flow into the river. Upon this the Board tried the methods of precipitation and deodorising, which had been unsuccessfully adopted at Leicester and Tottenham. Mr. Rawlinson stated that beween the law suits and these attempts at disinfection, the Board expended no less than £24,000; while, he added, the whole of the works for irrigation might have been completed for £20,000. As soon as the sewage was applied to the land the price went up to £4 per acre, and the Board sub-let it to Mr. Marriage for £5 per acre. From the evidence of the Chairman of the Croydon Board, it appeared that Mr. Marriage realised crops of grass on the 260 acres which produced him £32 per acre. He asked were not these instances sufficient to prove the profitable results of the application of sewage to the land? Mr. Morton had alluded to the case of Birmingham, and stated that the sewage was brought into tanks before the supernatant liquid flowed into the river. The soluble parts in this fluid, however, contained six-sevenths of the whole value of the sewage, and this, as stated, was carried away by the river. Mr. Morton had said that the soil was not permanently enriched by sewage, whilst a contrary opinion was entertained by Professor Way.

Mr. Morton explained that that expression referred only to the sandy slopes of Craigentinny.

Lord R. Montagu—One other subject was referred to by Mr. Morton, who stated that the rainfall throughout England was equal to an average of 3,000 to 4,000 tons of water per acre, but that the value of the soil depended very little upon that, but very much on the nature of the soil. The water percolated through light soil till it came to a bed of clay, and it ultimately made its appearance in the valley as a spring; but if it fell on clay soil it remained there till it was either evaporated by the atmosphere or percolated very slowly through the soil. In Huntingdonshire, which was his own district, the farmers complained that the land was overdrained; the water percolated quickly through the gravelly soil and the ground became parched. In the clay land districts the demand was for more deep draining. It was clear from this that sewage when applied to gravelly soils would enrich them; but if it were applied to undrained clay land it only made the evil worse. They already held the rain water, and unless the land were drained, it would only be made cold by the application of sewage water; therefore, the two subjects of the application of sewage and the drainage of heavy lands were intimately connected together. He would conclude by congratulating Mr. Morton upon his able and lucid paper, and by felicitating him also upon his fears that this country would soon be embarassed by a plethora of grass produce and by the consequent enormous amount of milk which would be produced. He thought the inhabitants of London could very well put up with a large supply of pure milk from Essex and other parts of the country.

The Chairman observed that there were evidently a considerable number of gentlemen present who were desirous to speak on this highly interesting and important subject, and, therefore, if it was agreeable to the meeting, he would suggest that the discussion be adjourned.

The discussion of this subject will be resumed on Wednesday evening next, the 8th February, at 8 o'clock.

Mr. Thos. Walker, of Birmingham, writes as follows:—

Many persons have the idea that the silt, or mud, and other suspended matters (of which there is but one ton in 1,170 tons of sewage) are alone valuable, and that the water is worthless. This is a great mistake. The most valuable manurial matters of the sewage are those held in solution by the water; the dirt being of small comparative value. The fœcal, urinal, vegetable, and animal matters passed into the sewers from water-closets, urinals, slaughterhouses, stables, markets, &c., are, in their passage from the sewers to the outlet, completely deprived of all their soluble portions, by the large volume of water always accompanying them. Let it therefore be well understood that the value of the sewage is in the water alone after the dirt has been taken out of it; as, however much clarified it may be, it will still hold in solution—as sea-water does its salt—all the soluble elements of the decomposed animal and vegetable matters; and only then is it in a fit condition to be used on grass land, as it would otherwise cover the grass with an injurious and offensive deposit and scum, which would close up the pores of the leaves and prevent their taking up atmospheric food. It is then also free from smell; the putrid and undecomposed matters having been all taken out; and, moreover, the solubles, being dissolved in and

incorporated with so much water, will keep sweet and clean for any length of time in the reservoir; besides which, the presence of the dirt would be liable to injure the large pumps, and to lodge in and choke up the carriers. The mud can be taken out, and, by itself, removed to any distance, there to be used as manure for other than grass land. For separating the solid from the fluid matters, years of experience have proved the filtering system to be impracticable, and that a simple settling pit is sufficient, provided that it be made large enough. The method I recommend is as follows:—I pass the sewage, direct from the sewers, into a trough of a certain form, and of a size proportionate to the flow and quality of the sewage; in this trough only the stones, grit, and other heavy matters subside, and from this trough the sewage passes, with its more fibrous suspended matters (through a grating that intercepts rags, paper, &c.), into a large settling pit, capable of containing several hours' flow, and of a convenient construction for facilitating the settling and subsequent emptying of the mud. (It is better to have two of these settling pits, so that the sewage may be depositing its mud in one while the other is being emptied.) In this latter pit the remaining non-decomposed matters are deposited by subsidence, the water passing off clear at its far end to pumping-engines. The pumping-engines, working night and day, will pump the clarified sewage through an underground cast-iron rising main to a large reservoir, capable of holding several days' flow, on any suitable high elevation, from which rising main and the reservoir, any land below can be irrigated by means of branch carriers, which will also be laid below the surface. The distance from the pumps to the reservoir may be several miles. To every 220 yards of the rising main there will be branches, right and left, to which will be attached long carriers, with 6-inch hydrants or taps at every 220 yards. There may be also large service-pipes, starting from the reservoir, in different directions, to be taken through other land where the sewage may be required, in the same manner as described in reference to the rising main and its carriers. As 220 yards square is equal to ten acres, there will, therefore, be a 6-inch hydrant to every ten acres, from which the farmers will (by trenches or otherwise) take their supplies. The farmers situated in any part of the district over which this net-work of carriers extends, will thus be able to have the sewage at any time and anywhere they may require it. The quantity used by each consumer can be ascertained by a water-meter attached to each hydrant, or so much an hour may be charged for each hour that each hydrant is open. The silt or mud is pumped by a diaphragm force-pump from the large pit, through an iron carrier, to any convenient destination. It will be better to have a small separate engine to work the mud-pump, as it will only have to be in action a few days in each month, when the mud is required to be removed; whereas, the Cornish pumping engines, by which the clarified sewage is elevated, will have to be worked night and day. Before concluding, I will make a few remarks on the subject of the Birmingham sewage. The Birmingham Corporation have spent many thousands of pounds in constructing filtering beds and tanks for the detention of the solid or suspended matters of the sewage, not with any view to its utilization, but for the sole purpose of keeping the mud out of the river Tame, as they are under an injunction forbidding them to pass it into that river, into which, however, the valuable clarified sewage is still allowed to flow. The corporation have laid down works for the removal of the mud deposited in the subsiding tanks direct to boats, on a canal about 500 yards away from the tanks, by forcing it through a carrier rising some yards on its way to the boats, by means of the diaphragm pump before referred to, and are sending it to farmers on the banks of the canal for use on their land. Birmingham, from its population of 300,000 inhabitants, produces 12,000,000 gallons of sewage daily, being 40 gallons per head per day, or 20,000,000 tons per annum, which would give 4,000 tons each for 5,000 acres, or 1,000 tons each for 20,000 acres. We find, by the levels of the district, that we should be able to have a summit reservoir not more than 100 feet above the mouth of the sewer below which there is plenty of adjacent land to consume the whole of the sewage, even if it were used over 20,000 acres, the owners of which land would doubtless be willing to pay such a price for it as would amply repay the company supplying it, even if the sewage were sold at very much below its real value. The average value of the fertilising elements held in solution by each ton of town sewage, has been variously estimated by chemists, at from 2d. up to 3½d., taking the price of guano as the standard. This 2d. to 3½d. is without taking into account the irrigating value of the water itself, which latter consideration accounts for the farmers who have used it in light dressings having found it to be worth from 5½d. to 9d. per ton. Now, as 4,000 tons per acre per annum have, in some cases, been applied—although it would be more economical and productive to use it over a larger area, and the cost of plant would be less in proportion—we will take that as our basis to get at an estimate of the cost of works required.

Estimated Cost of raising Sewage.

The average duty of Cornish engines is 56,000,000 lbs. raised one foot high, with one bushel, or 94 lbs., of Welsh coal, the cost of which would be, say 5d., reckoning the coal at 10s. per ton.

As 56,000,000 lbs. are equal to 25,000 tons, we have:—

	25,000 tons raised	1 foot for	5d. cost of fuel		
or	250	,,	100 ,,	5	,,
,,	100	,,	100 ,,	2	,,

The cost of fuel for raising 100 tons 100 feet high would therefore be 2d., which gives £4 11s. 4d. as the daily expense in fuel. If to this be added 2d. per 100 tons for wages, grease, and other incidental expenses, the daily amount of which would likewise be £4 11s. 4d., and is evidently sufficient, the total outlay would be £9 2s. 8d. per day, or £3,333 13s. 4d. per annum, for raising the whole of the Birmingham sewage to the above-mentioned reservoir. Any water-works engineer will verify this statement. The cost would therefore be 4d. for 100 tons, including fuel, wages, and all other working expenses. This gives twenty-five tons for 1d. I have carefully considered the cost of constructing the necessary works for the utilisation of the Birmingham sewage over 5,000 acres of land, and am of opinion that, inclusive of purchase of land, parliamentary expenses, 62½ miles of iron pipes, 500 hydrants (being one to each ten acres), the summit reservoir, Cornish engines, pumps, and other apparatus, the total capital required would not exceed £140,000.

Estimated Value of Sewage per Annum.

20,000,000 tons, even at ½d. per ton, will amount to......................£41,666 13 4

This ½d. per ton is not near the value of the fertilising elements held in solution, exclusive of the irrigating value of the water itself; but I have put the sewage down at ½d., to show that at that low price it would still pay good dividends, even if only two-thirds of it were paid for.

Annual working expenses, including fuel, wages, &c., for raising the whole 20,000,000 of tons to the reservoir, 100 feet high £3,333 13 4

Annual Income and Expenditure.

	£	s.	d.		£	s.	d.
Working expenses.	3,333	13	4	Value of the sewage at ½d. per ton	41,666	13	4
Sinking fund 5 per cent.	7,000	0	0				
Leaving for dividend and office expenses...	31,333	0	0				
	41,666	13	4		41,666	13	4

Proceedings of Institutions.

THE METROPOLITAN DISTRICT.—Mr. H. H. Sales, Visiting Officer of the Society of Arts for the Metropolitan District, writes as follows:—" Since the commencement of the winter season, the work of the Society of Arts, with reference to education, has made great progress in this district. Previously, but few classes, apart from Institutions, had been established for advanced subjects. The standard of attainments in the ordinary night schools was too low to meet the requirements of the Examiners or the Society, even in those schools that attempted to give instruction in other subjects than reading, writing, and arithmetic. In September, classes, on the same plan as that adopted in the City of London College and London Mechanics' Institution, were opened in St. Michael's School-room, Bromley, by Mr. Edmund Hay Currie. The fees paid by the pupils render the classes self-supporting—a most important element as regards their success—and at the same time are sufficient to engage the services of most efficient teachers. The classes of the West London Youths' Institute have been remodelled on a similar plan. In Bethnal-green, self-supporting classes have been established in Abbey-street Schools, and likewise in St. James's Schools, Ratcliffe. A Board of Education for the parish of Islington is in the course of formation, and the organization of classes will form an important part of its operations. The displacement of the common night school by efficiently-conducted, self-supporting special classes, is a marked feature in connection with the progress of adult education in the metropolis. It must not be supposed that the rudiments of education are neglected under this class system. In all these classes an elementary class is included for instruction in reading, writing, and arithmetic, and is generally conducted by a certificated school-master. The Society's system of examinations, certificates, and prizes, gives a collegiate form to the classes, and exerts a great influence upon the students. I regret to say that I cannot bear like testimony to the present scheme of Elementary Examinations conducted by the District Unions. A working man who wishes to study some particular subject, while recognising the wisdom of the Society's regulation respecting a preliminary examination in reading, writing, and arithmetic, cannot see the use of being likewise compelled to study geography and English history; and, consequently in my district the great majority of the candidates who will present themselves in the ensuing Final Examinations will obtain a "pass" from a Local Board, and not a "certificate" from the District Union. Although this action will not affect the Society's Final Examinations, yet it will seriously influence the Elementary Examinations held in connection with it by the Metropolitan District Union. I am strongly of opinion that the Lower Grade Examination should be confined to reading, writing, arithmetic, and dictation; and certificates should be awarded in the Higher Grade for greater proficiency in the same subjects together with elementary grammar and composition, and that geography, English history, and Gospel history should be excluded from the Lower Grade, and not be indispensable for a certificate in the Higher Grade. If the Lower Grade Examination was a stepping stone, as it were, from the day school to the evening class, and the Higher Grade certificate a standard of proficiency in elementary knowledge, I submit that the Elementary Examinations held by the District Unions would then assist in carrying on the education of the day school, and in preparing duly qualified candidates in elementary knowledge for the Final Examinations."

OPERATIVE COACHMAKERS' INDUSTRIAL EXHIBITION.

On Wednesday, the 1st of February, the public opening of the Operative Coachmakers' Industrial Exhibition, in the Coachmakers' Hall, Noble-street, took place in the presence of a large number of persons, the Marquis of LANSDOWNE presiding at the ceremony. The very reverend Dean Milman was also present, and several members of the Coachmakers' Company.

Mr. G. N. HOOPER, of the Haymarket, read an address on behalf of the committee of management, from which the following is extracted:—

" On the occasion of publicly opening the first Industrial Exhibition of the Operative Coachmakers of London, in this corporate hall, every one must feel that a striking contrast is presented between the present state of the coachmaking trade, and the position it occupied when the Company of Coach and Coach-harness Makers received its charter from the hands of King Charles II., May 31st, 1669. At that period trades were mysteries and their processes secret. The present exhibition, however, illustrates a vast change, not only in the processes employed, but in the altered state of feeling on the part of employers and workmen, who now court inquiry, comparison, and inspection of their work, hoping to interest the public by showing how much ingenuity, patience, and care are necessary for the production of a first-rate carriage. Carriages of a rude and uneasy description were invented at a very early date, and were in use among the Israelites, Egyptians, and Assyrians, as recorded in the sacred writings and upon their sculptured monuments. The Greeks and Romans made very little improvement upon the Egyptian carriages, beyond inventing four-wheeled vehicles, and the art seems to have slumbered for many centuries. It revived at length and attained great excellence in Italy in the fifteenth and sixteenth centuries, and became spread over other countries. In the time of Queen Mary, 1556, we find mention made of a coach suspended on leather braces; this may have been sent to her from Italy, by her relations who then ruled over that country. This was the commencement of the improvement in the art of coach building in England, and this art was soon so extensively patronised that the writers of the times foretold that the use of carriages would enervate and enfeeble the people, who ought to be satisfied to travel on horseback as their forefathers had done. We may congratulate ourselves, however, that although carriages are now in daily use by all classes of society, we see no signs of that enervation which our ancestors predicted. Since the introduction of railways, the number of carriages has multiplied to an extraordinary extent, assisted by the reduction of the tax upon them, by Mr. Gladstone, in 1853. This increase, has moreover, stimulated industry and invention. The sound and honest character of English carriages has long been appreciated throughout Europe and every country in the world, and for many years has secured a preference for the English trade. Our carriages have, for upwards of half a century, been considered the best in the world, both in design and durability. The idea of rewarding working men for great skill, as well as master manufacturers, is not new; like many other seeds, destined to bear good fruit, this idea arose during the organising of the Great Exhibition of 1851. It is a matter of regret that we have not been able to promise protection and full security for inventors of new and useful improvements. The patent law, as it at present exists, is both an evil and a good, the dread of exhibiting before the invention is secured often prevents the very exhibition in which hints for perfection might be gathered on one hand, and beneficial sale for the improvement be secured on the other by this sort of publicity. These exhibitions specially offer encouragement for young journeymen to make known their own original ideas by drawings and models; they can thus gain opportunities for advancement and becoming known. Had the committee been able to make the proposed exhibition more generally known, and to have given longer time to prepare objects for exhibition, a much larger number of exhibitors and interesting drawings and models

would probably have been the result; but the near approach to the London season, during which the time and strength of both master and man are taxed to the utmost, forbade any lengthening of the time of preparation, and to defer the exhibition to the autumn might have been to cool down the cordial and expectant feeling that had been raised. It was thought better that a small collection of objects sufficient to fill the hall, containing in itself examples of modern progress, with relics of the past and memorials of true excellence in the art, the whole enshrined in its fitting place of exhibition, the hall of the Company of Coach and Coach-harness Makers, would be better than attempting a more ambitious exhibition."

After an address from the Chairman,

The Old Hundredth Psalm was sung. The Dean of St. Paul's having offered up a prayer, the Anthem, "Thine, O Lord, is the greatness," was chanted by amateurs, who were coach operatives; and, after "God save the Queen," the Chairman declared the exhibition to be open.

SOUTH LONDON INDUSTRIAL EXHIBITION.

This Exhibition was inaugurated by the Bishop of Winchester, on Wednesday last, at the Lambeth Baths, in presence of a moderately large assemblage. The guarantee fund for the present exhibition is £1,108 5s. 6d., an ample sum for the purpose, and a large number of the guarantors are working men. The prize of £5 for a design for a commemoration medal has been awarded Mr. R. W. Martin, a working man of Walworth. A gallery runs round the walls of the building, and on the front are hung panels recording the various places in the south metropolitan districts from which articles have been collected. There are numerous models of villages and of ships, drawings, paintings in water-colours and in oil, as well as plaster busts and models in terra cotta. The whole exhibition numbers 640 articles of various kinds. The Bishop of Winchester delivered an address, and some hymns were sung.

Fine Arts.

Estimation of Works of Art.—The tide seems to run just now more strongly in Paris in favour of the work of French artists than of those of the great masters of Italy and Flanders. Not that any work of any French artist will fetch, even in the Paris market, as much money as a Raphael, a Michael Angelo, a Rubens, or a Murillo, but the relative value of the former is certainly on the rise. At a sale of the works of the sculptor Cordier, a living artist, 58 items realised 59,000 francs (£2,360). The statue of an Arab woman, in onyx and bronze, was purchased by the Duc de Morny for 6,825 francs; a marble statue, called "La Belle Gallinara," seen in London in 1862, if we remember rightly, was sold for 4,100 francs; and two other statues for 3,800 and 3,000 francs respectively.

Sale of a Venetian Glass.—A most extraordinary instance of growth in the value of an article was exhibited the other day at the sale of the collection of M. Alfred de Knyff, at Brussels. A glass, of Venetian manufacture, which had been purchased but a short time since for one franc, was purchased by a dealer for 1,000 francs.

The New Hercules.—The Pontifical Academy of Archæology has decided that the colossal statue of Hercules, found beneath the ruins of the Theatre of Pompey, shall be placed in the Vatican, and that it shall bear the title of the *Ercole di Mastai*, in honour of Pius IX. It is a pity that the name by which it is to be known does not rather indicate its origin.

Public Monuments.—The Emperor of the French has decided that a statue of Dupuytren, the celebrated surgeon, shall be raised in Pierrebuffière, in the department of the Haute-Vienne, the place of his birth. A commission has been appointed, and special application will be made to the learned societies. The Comte de Cardailhac, director of buildings for civil purposes, under the Minister of State, is appointed receiver of the subscriptions and treasurer.—The statues of Cavour and of Italy which are to surmount the monument to be raised in Milan in memory of the great minister of Victor Emmanuel, are now on view at the royal foundry in Florence. The sculptors are Antonio Tantardini and Odoardo Tabacci, and the casting in bronze is entrusted to Clemente Papi.—Four statues were recently set up in the grand vestibule of the Royal University of Naples, representing Pier delle Vigne, Thomas Aquinas, Jourdain Bruno, and John Baptiste Vico. Professor Settembrini seized the occasion to present a plaster bust of Humboldt, from a model by Rauch, and proposed that a subscription should be entered into amongst the professors of the University for its execution in marble. The suggestion was taken up warmly. The sculptor Angelini made a present of a fine block of marble, and a young artist, named Uriele Vitolo, was entrusted with the execution of the work.—A grand monument is about to be raised to Catherine I. in St. Petersburg. A statue of the Empress, which is said to be particularly fine, is to be placed on a pedestal decorated with figures of the following celebrities of the period:—Derjavine, Madame Daschkow, Betski, Bezborodko, Roumiantzow, Potemkin, and Souwarrow. The whole is to be the work of Mikechine, whose original design was to be seen at the London Exhibition of 1862, where a medal was awarded to the artist. Considerable alteration, however, has since been made in the plan and statues. The cost of the whole is estimated at 250,000 roubles.

Manufactures.

Ammoniacal Gas as a Motor.—M. Ch. Tellier has conceived a new and curious application of this gas. He proposes to take advantage of its peculiar properties, and use it, in certain cases, as a substitute for steam. The qualities referred to are, its great solubility in water, its easy liquefaction, its power of supplying motive power at the ordinary atmospheric temperature, the capability of its vapour being superheated without too great an increase of the temperature, the possibility of re-collecting it by solution, and the faculty of extracting the latent heat from its vapour, after the latter has been employed, and transmitting it to that which is about to be used, by the simple act of dissolving the gas in water. With a given quantity of ammoniacal gas and three times its weight of water, says the inventor, the whole of the former may be vaporized and used as a motive force with a pressure of 8 to 10 atmospheres, and the action would be constant because the latent heat required for the vaporisation would be constantly reproduced by the caloric released by condensation. So that liquid ammonia is said to supply an instantaneous and practical means of obtaining a motive vapour. With about 22 lbs. of the liquid, we are told, the force of one horse may be obtained for an hour. The inventor does not pretend to place this system in competition with the steam-engine, but only where the production of steam would be impracticable and inconvenient. For instance, he says, "an omnibus, drawn by two ammoniacal horses, only need carry about 40 lbs. of liquid ammonia and 120 lbs. weight of water. This would supply a simple motor, without smoke or steam, instantaneous in its action however long and frequent were the stoppages, and with an economy over horses of at least 75 per cent." M. Tellier also recommends his invention for steep inclines on railways, tunnels, mines, and other places where heat cannot be tolerated.

Tobacco Manufactories in France.—It is well known that the manufacture of tobacco, snuff, and cigars is a State affair in France, as in some other countries. There

are seventeen establishments of the kind in France, two in Paris and one in each of the following towns:—Bordeaux, Châteauroux, Dieppe, Havre, Lille, Lyons, Marseilles, Metz, Morlaix, Nancy, Nantes, Nice, Strasbourg, Tornveins, and Toulouse. The total number of persons employed in these seventeen factories is stated to be nearly 17,000, the two establishments in Paris alone having nearly 3,000. The amount paid for salaries and wages was, in 1862, £335,256, and adding to this the sums paid to agents and others, the total expenses of the tobacco manufacture in France amounted to 11,380,949 francs, or, in round numbers, £455,238.

Obituary.

Mr. J. B. Neilson, the inventor of the hot blast, died recently. This invention may be said to have revolutionised the iron trade, and added largely to the sources of wealth and happiness throughout the world. The west of Scotland has especially benefited from the stimulus which this invention has given to the development of its mineral treasures during the last 35 years. In 1828, when the hot blast was invented, the produce of the smelting furnaces of Scotland was not more than 29,000 tons per annum; in 1864 the produce was 1,160,000. In 1828 the average selling price of a ton of pig iron was about £7; while in 1864 it was £2 17s. 3d. A large, if not the largest, portion of this increased production and money saving is to be traced more or less directly to the general adoption of the hot blast process. Even before Mr. Neilson's patent expired in 1842, the process had become general in all the iron-producing districts of Europe and America, and was even practised in India. Mr. Neilson was a native of Shettleson, near Glasgow. He was born in 1792, and was brought up as a working mechanic. Mr. Neilson had been twice married, and has left a numerous family.

Notes.

Exhibitions.—The acclimatisation of exhibitions seems to be complete. Shows, artistic and industrial, temporary and permanent, are announced in all directions. Rome is to have a general Exhibition this summer. Cologne announces an international one of agriculture and objects of domestic economy, to open on the 15th of May in this year, in the grounds of the Horticultural and Floral Society, established close to the town, under the patronage of the Queen of Prussia. The Crystal Palace of Oporto is announced to open on the 21st of August; the spot selected for this building is a commanding eminence, from which the Douro may be seen falling into the ocean. On the opposite side is the chapel erected to the memory of King Charles Albert, father of Victor Emmanuel, who died at Oporto. To the east, but at some distance, are the mountains of La Beira, the famous vineyards of Douro, whence comes the Duke of Wellington's second title. Attached to the property of the Exhibition Society is a park, which belongs to the house in which Charles Albert died. The spot selected is about twenty minutes' walk from the town of Oporto, which will shortly be connected, directly, by rail with the Spanish and French lines. The Industrial, Agricultural, and Horticultural Society of the Department of the Haute Marne, announces an Exhibition for the month of May. This department, which is a six hours' journey from Paris, is the centre of the metallurgical industry of the east of France, and, doubtless, the great iron works of Champagne, Lorraine, and Franche-comté will be well represented. The cutlers of Nogent, who have a high reputation, and employ upwards of six thousand workmen, will make a good show. This is not the first Exhibition of the kind that has been held at Chaumont, but it is expected to be on a much larger scale than those which have preceded it. It is said that a company has been formed at Brussels with the view of establishing, at Lacken, a permanent exhibition of objects of industry and works of art. To this may be added the reminder, that Exhibitions of Fine Arts open during the two coming months at Bordeaux, Pau, and Glasgow.

British Association.—A public meeting was held recently in Dudley, called by the Geological Society, to consider what steps should be taken in South Staffordshire for receiving in a suitable manner the members of the Association at their visit to Birmingham in September next. It was stated at the meeting that one of the most interesting features in the district would be the manufacture of iron, and the geology of Dudley. It would be very desirable that the committee formed in South Staffordshire should prepare a full report on the state of the district iron trade, and on the coal-fields. It was hoped that the district would co-operate in obtaining papers for the various sections bearing on the scientific features of the locality. Mr. Frederick Smith, agent to the Earl of Dudley, announced that his lordship would have every accommodation for the Association on their visit to Dudley; and his grounds, caverns, collieries, and ironworks would be thrown open for their inspection. A committee was formed to make the necessary arrangements for the reception of the Association, and a resolution was passed, requesting the manufacturers of the district to subscribe towards the fund to defray the necessary expenses.

French Academy of Sciences.—There has been a sharp struggle of parties with respect to the filling the vacant seat in the section of mechanics in the above academy, and a curious departure from the ordinary mode of procedure. Three names were put forward in the usual way, when that of Colonel Favé, the Aide-de-Camp of the Emperor, was proposed, and added to the list by a vote of 31 in a meeting of 58 members, whereupon that of M. Léon Foucault was also proposed and adopted by 36 out of 49 votes. The speech of M. Delaunay, who proposed Colonel Favé in the secret committee, having been printed and distributed by its author, five of the members moved a resolution that the whole of the discussion should be given to the world. It is said that Baron Charles Dupin, M. Combes, and the Generals Piobert and Morin, made a vigorous opposition to the colonel's nomination. The result of all this has been the defeat of that gentleman, and the publication of the fact that he was in reality the representative of his Imperial master. As regards the claims of the two candidates already named, it is said that the discussion has established the fact that the idea of the rifled field artillery was really the Emperor's own, and not that of Colonel Favé, and that the latter was only the author of a faulty sketch for the siege guns used at the Battle of the Alma; and that the plating of ships of war was the work of the commission headed by M. Dupuy de Lôme, the chief constructor of the Imperial Navy, and M. Garnier. The claims of the colonel's opponent, M. Léon Foucault, are well known to the scientific world; his great telescope, and various apparatus for astronomical and other observations, have earned him an European reputation. M. Bertrand and M. Le Verrier supported his claim to the vacant chair, and after several divisions and one adjournment, M. Léon Foucault obtained a majority. Before, however, he takes his seat in the academy, his election will have to be confirmed by the Emperor, to whom all members elect are presented in person by the officers of the academy.

Correspondence.

Propelling Trains on Lines with frequent Stations.—Sir,—My suggestion as to motive power is so evidently misunderstood by your correspondents, that I beg to add some remarks on the subject. The argument of these

gentlemen appears to be that the present average speed (about 14 miles when travelling) cannot be improved without getting too rapidly into motion. I cannot agree to this proposition, but believe that great improvement can be made (certainly up to 20 miles) without undue acceleration and that existing companies will be compelled ultimately by competition to adopt a superior rate of travelling. There is nothing said in my paper to justify the supposition that I propose to put trains suddenly into motion, as the acceleration now made by locomotives in descending gradients, if adopted generally, would make the average above 20 miles per hour. I cannot doubt but that companies having frequent stations, will give due consideration to the subject, and ascertain whether responsible mechanical engineers will lay down and maintain machinery on the plan proposed, and guarantee an improved rate of travelling at reduced cost. —I am, &c., Peter W. Barlow.

London Mud.—Sir,—London dirt is proverbial, and I have heard countrymen go further, and say that Londoners love dirt; and, having been recently in London, I begin to believe I may say that I skated from Charing-cross to Blackfriars, even by the door of the Society of Arts, and no attempt appeared to be made, except here and there, to remove the accumulated mud. Why is this? Can it not be removed? I believe it can; but if there be a difficulty, pray ask the Council to offer a prize. My own lucubrations, being caught in a heavy shower to-day, teach me that it can be done, and that that very thrifty dame, Nature, shows us how. Well, then, what I would propose is, that we should imitate her. The rain runs from the centre or highest part of the road to the gutter, and from the shop door to the same gutter. Now, if a simple iron pipe, perforated right and left with holes, ran along the centre of the road, and another in front of the doorway or under it, in either case very slightly raised above the road level or pavement, the whole might be very cleanly washed every morning. Further, if the pavement or stones were bedded in asphalte much accumulation of dirt would be avoided, but without this, if duly and persistently washed day by day, the evil would be overcome, and London be as clean and comfortable as the well-washed portion of its population is. Excuse these hasty thoughts of a sufferer, and if possible turn them to account.—I am, &c., Antigrophilos.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Arts, 8. Cantor Lectures. Professor Ansted, F.R.S., "On the Application of Geology to the Arts and Manufactures." (Lecture I.)
Royal Inst., 2. General Monthly Meeting.
Entomological, 7.
British Architects, 7.
Medical, 8. 1. Dr. E. Symes Thompson, "Notes on Cases of Tumours in the Mediastinum." 2. Mr. Teenan, "On certain Fractures of the Skull."
Asiatic, 3.
R. United Service Inst., 8½. 1. Mr. R. Cail, C E., "Guns, and Cail's Rifled Projectiles." 2. Rev. Andrew A. W. Drew, "Proposed Plan of Building Iron-clad Ships to carry Heavy Guns on the Broadside, with increased Facility of Working them, and Protection for the Crew."
Tues. ...Civil Engineers, 8. Mr. Edward Johnston, "The Chey-Air Bridge, Madras Railway."
Pathological, 8.
Photographic, 8. Annual Meeting.
Ethnological, 8. Prof. Busk, F.R.S., "On Human Remains from Gibraltar."
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."
Wed. ...Society of Arts, 8. Renewed discussion on Mr. Morton's Paper, "On London Sewage from the Agricultural Point of View."
Geological, 8.
Graphic, 8.
Microscopical, 8. Annual Meeting.
Literary Fund, 3.
Archæological Assoc., 8½.
Thurs...Royal, 8½.
Antiquaries, 8.
R. Society Club, 6.
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."
Fri.......Astronomical, 3. Annual Meeting.
Royal Inst., 8. Mr. W. G. Palgrave, "On Arabia."
Sat.......Royal Inst., 3. Prof. Marshall, F.R.S., "On the Nervous System."
R. Botanic, 3¾.

Patents.

From Commissioners of Patents Journal, January 27th.

Grants of Provisional Protection.

Atmospheric air, machinery for condensing—96—J. G. Jones.
Atmospherical machine—3143—E. C. M. Bonnier.
Brooch fastenings, &c.—60—J. J. Blackham.
Carbonaceous minerals, treatment of—40—J. E. Vigoulete.
Dredging machine—2621—J. Sourd.
Engraving on crystal, &c.—88—R. A. Brooman.
Fire-arms, breech-loading—3165—T. Woodward.
Fire-arms, breech loading—78—A. and M. Meyer.
Gas, purification of—2883—A. A. Croll.
Guano, treatment of—50—T. Richardson and M. D. Rucker.
Guns, method of operating—3029—W. E. Newton.
Hulling grain, apparatus for—38—G. A. Buchholz.
Iron safes—2485—W. Gardner.
Jacket or protector for metallic vessels, &c.—4—E. Bevan and A. Fleming.
Levels—2987—F. B. Dœring.
Liquids and fluids, heating and evaporating—3131—A. A. L. P. Cochrane.
Match splints, &c., machines for cutting—74—J. C. Brown.
Metallic bedsteads, manufacture of—58—J. Atkins.
Oils and hydrocarbons, treatment of—3252—L. P. E. Max.
Paper board, manufacture of—62—J. F. Jones.
Paper, manufacture of pulp for—80—W. Clark.
Pincers for gas pipes—86—W. E. Gedge.
Pins and hackles, manufacture of—3236—T. R. Harding.
Rails, construction of—3068—S. Truss.
Railway trains, communication between passengers and guard—30—C. Pickworth.
Rice, coffee, &c., apparatus for cleaning—64—J. H. Johnson.
Sewage, &c., utilisation of—3115—W. Bardwell.
Sewing machines—36—A. V. Newton.
Smoke, flues for the consumption of—98—A. Cooper.
Tobacco, manufacture of—68—W. Davies.
Train signalling, apparatus used in—52—E. Tyer.
Vacuum pans—57—E. Beanes and C. W. Finzel.
Vessels, ascertaining the depth of water and speed of—3079—A. Baker.
Washing, &c., machinery for—32—J. W. Branford.
Zinc ores, smelting—46—A. Reynolds.

Inventions with Complete Specifications Filed.

Mowing and reaping machines—200—W. E. Newton.
Sewing machines—203—A. C. F. Derocquigny and D. Gance.

Patents Sealed.

1887. J. Cope.	1971. L. Young.
1890. W. Anderton.	2023. J. Dilkes and E. Turner.
1900. W. Payton and J. Stanley.	2211. C. J. Newbolt.
1901. T. Bourne.	2391. A. Cuthell.
1905. P. H. Moore.	2701. W. Rice.
1906. E. Tattersall.	2746. G. Haseltine.
1907. R. A. Brooman.	2873. G. T. Bousfield.
1924. M. Woodifield.	

From Commissioners of Patents Journal, January 31st.

Patents Sealed.

1914. H. T. Davis.	1959. R. Edmondson.
1917. R. Kay, J. Manock, and G. Dakin.	1962. C. Bartley.
	1967. W. Collins & W. Pountney.
1926. E. Brasier.	1977. W. Richards.
1931. C. Garton and T. Hill.	2010. G. Davies.
1938. M. A. Soul.	2025. A. C. Pilliner & J. C. Hill.
1941. F. Cruickshank.	2147. J. H. Johnson.
1942. J. and M. Radcliffe.	2188. W. Clark.
1948. F. J. Bramwell.	2675. A. Parkes.
1950. G. F. Marchisio.	2853. J. P. Nolan.
1952. J. Lee.	2992. J. McIntosh.
1953. I. Farrell.	

Patents on which the Stamp Duty of £50 has been Paid.

174. W. H. Ropes.	223. G. H. and E. Morgan.
123. T. and E. Myers.	208. C. W. Harrison.
197. D. Edleston and H. Gledhill.	218. M. A. F. Mennons.
	293. J. L. Norton.
199. J. Wright.	356. W. Wood.

Registered Designs.

Holder for Crochet and Tambour Needles—Jan. 20—4686—J. Shrimpton and Son, Studley, near Redditch.
For Working the Fastenings of Taps, and other like articles—Jan. 27—4687—M. Bermange and Company, 21, Queen-street, City, E.C.
Jelly Strainer—Feb. 1—4688—John Marston, London Works, Bilston.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, FEBRUARY 10, 1865. [No. 638. VOL. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

CANTOR LECTURES.

The Second Course of Cantor Lectures, the subject being "The Applications of Geology to the Arts and Manufactures," by Professor D. T. ANSTED, M.A., F.R.S., is now being delivered on Monday evenings, at Eight o'clock, as follows:—

FEB. 13TH.—LECTURE 2.—On Natural and Artificial Springs, and on the various Sources of Water Supply for Towns and Cities, in connection with the Geological Structure of the Vicinity.

FEB. 20TH.—LECTURE 3.—On Mineral Materials used for the Purposes of Construction: Plastic and Incoherent Materials (Clays and Sands).

FEB. 27TH.—LECTURE 4.—On Mineral Materials (*continued*): Building Stones and Slates, and their Relative Value under given Circumstances of Exposure, and on Methods of Quarrying.

MARCH 6TH.—LECTURE 5.—On Stratified Deposits of Minerals, as Coal and Iron Ore, usually obtained by Mining Operations, and on Mining Methods for such Deposits.

MARCH 13TH.—LECTURE 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture. For this purpose a set of Tickets has been sent to every member.

FINAL EXAMINATIONS—BOTANY.

In addition to the Prizes in this subject offered by the Society of Arts to candidates taking a Certificate of the First Class, the Royal Horticultural Society offers five prizes, of £5, £4, £3, £2, and £1 respectively, to the five candidates being gardeners by profession, who, taking any grade of certificate in Botany, obtain the highest number of marks in that subject at the Final Examinations in April next.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

FEB. 15.—"On the Claims of Authors and Inventors to Property in and Protection for Designs and Inventions first published at Industrial Exhibitions." By THOMAS WEBSTER, Esq., Q.C., F.R.S.

FEB. 22.—"On the Municipal Organisation of Paris, especially with reference to Public Works." By GEORGE R. BURNELL, Esq., F.G.S.

INSTITUTIONS.

The following Institutions have been received into Union since the last announcement:—

Rawtenstall Mechanics' Institution.
Tottington (near Bury) Mutual Improvement Society.

Proceedings of the Society.

CANTOR LECTURES.

SECOND COURSE.—FIRST LECTURE.—MONDAY, FEB. 6.

Professor ANSTED commenced by stating that he proposed, in these lectures, to introduce the subject of the various practical applications of geology. He was aware of the difficulties; for, on the one hand, the facts were so numerous that if merely enumerated and tabulated they could not all be placed before his audience in the time at his disposal; and, on the other hand, if he were to generalise without facts and statistics, he could not expect that the great importance of his conclusions should be appreciated. He considered that an account of the working out of the great theorems of geology, and their bearing upon agriculture, architecture, engineering of all kinds, and mining of all kinds,—their influence on the progress of the arts of construction, and on the discovery of the material of which things are constructed, could not want interest, and need not be useless because it was brief. In treating of the applications of geology, it would be convenient to take advantage of certain natural divisions which the subject offers. The earth was both the place itself on or within which everything was done, and it yielded all the material by which everything was done. We had to employ the earth as it was presented to us by nature, and to do so we had to discover and remove from the earth the means of using this same earth to

advantage. On the applications of geology, that which had reference to agriculture was the one to be considered this evening. It was one involving many details and many principles. On the part of those who entered on the subject, a certain knowledge of geology must be presumed, but the lecturer thought it well to lay down, in a few words, in mere outline, a statement of those facts that were chiefly concerned in its reduction to the use of common life. The surface of the earth, in the cultivated parts of a country, consisted of vegetable soil. In parts where the soil was barren this might be sand or stones, but it concealed the rock. In a fertile district only a very small proportion of the surface exposed the rock to view. In England, almost everywhere on the east side of the country there was soil of some kind; while on the western extremity there were large tracts of barren rock. Every country had its own *facies* in this respect, and even where soil existed its thickness and general character were very variable. Whatever the thickness might be, however, there was always a termination to the soil, and below it was a subsoil partaking of a mixed character, between soil and rock, while below the subsoil was the rock, often exposed in quarries and railway cuttings, or in fragments brought up when water was sought for. Even the channel cut through by a stream, however small, would often be found to give a geological section. Rocks were of various kinds, but the varieties might be included within certain general and familiar terms. Such were limestone, sandstone, clay, granite, basalt, slate, &c. Mixed fragments of these formed gravel when loose, and conglomerates or pudding-stones when cemented together. More minute fragments ground to powder were sand. Of these, some were stratified, others unstratified. So, again, some were aqueous, others igneous. Others, again, and these were very numerous, might or must have been formed with water, but were now so far changed as to have lost their aqueous character. These were metamorphic. Limestone was an aqueous rock, and stratified. Basalt was an igneous rock, and might or might not be in strata. Slate was an aqueous rock, but metamorphic. Granite was metamorphic, and generally unstratified. Stratified rocks were generally tilted, and it was even possible that beds once horizontal might be actually inverted, and made to dip the wrong way. Rocks occurred in series. Often a multitude of stratified rocks were found in the same district, some of them being much more tilted than others. Stratified rocks were often interpenetrated by those that are metamorphic or igneous, but sometimes the metamorphic and igneous would alternate with the aqueous. Such were some of the simplest and most significant facts of geology bearing on those practical questions to be considered in these lectures. Rocks were the mineral constituents of the earth beneath any vegetable soil that might have accumulated upon them. They would yield to the chemist a ready account of their composition, and to the student investigating them for that purpose, a clear outline of the mechanical changes they had undergone; while they were often sufficient to enable the geologist to determine a complete outline of events, and a history of changes that may have taken a long time to complete. Owing to the mixed origin of rocks, it had happened that most rocks were broken and fractured, the cracks being filled up more or less completely with minerals, generally crystalline. Every kind of vegetable soil was once rock, which had been broken down by degrees into fragments, until at last it was reduced to mud. The part of this process performed by the atmosphere was called weathering. Wherever rock was exposed to the air, it became weathered; and weathering meant ultimately a reduction to fine powder. On granite or quartz rock, a group of small lichens was seen to grow. These were insidious enemies, as, although they derived their nourishment chiefly from the atmosphere, and might be thought even to protect the exposed surface from the weather, they paved the way for destruction. That which they separated from the air became a brown pulverulent mass, or *humus*, which afforded nourishment to larger individuals of the same tribe. Mosses succeeded lichens, and small crevices received their roots. Once inserted, these roots expanded, splitting asunder the rock. Other roots were thus enabled to penetrate yet further; and after a time the mosses were followed up by heather, grasses, and small shrubs; until at length there was attained a sufficient thickness of soil to enable trees to grow, thrusting down their rootlets in the crevices and making room for the admission of rain. Then frost coming, rending asunder the rock, which would fall into the valleys below, spread over the surface and being lost sight of, being washed away by the rain. In certain soils the underlying rock was found in situ, in angular fragments and recognizable; elsewhere the fragments were water-worn, and belonged to some distant mountain or hill. This transported material was more common than the other, for water had everywhere been at work. Thus alluvial soils were formed. The solvent power of water was a very important agent in weathering. On detached fragments of limestone, water and vegetation together acted as a drill. Of sandstones it dissolved the calcareous cement, or even the silica itself. Thus in a mixed rock, as basalt, great differences of composition existed between an unweathered and a weathered specimen, and in a particular case referred to, 65 per cent. of the soluble alkalies had been removed, 28 per cent. of the alkaline earths, nearly 20 per cent. of the silica, only 2½ per cent. of the iron oxide, and no appreciable quantity of the alumina. Productive soils were composed partly of mineral substances and partly of certain products of the decomposition of organic bodies. This latter portion was called *humus*. It consisted largely of carbon, and carbonic acid was mixed freely with the water that passed through fertile soil. Humus was not generally present in soils in large proportion, but was abundant in peat and moor soils. The mineral constituents of a soil were of two kinds: the one kind we might call earth, as being a disintegrated mineral substance, the other consisted of fragments of the rock from which the earth was derived. The latter we might call stones. The former rendered the ground arable; the latter increased the bulk of the soil and facilitated the action of rain and frost, but contributed nothing to nutrition. Clay, lime, and sand formed the staple of all rocks, and were the ingredients of chief importance in every cultivable soil. Clay was a silicate of alumina, capable of retaining a large quantity of water, forming with it a tenacious, compact, sticky paste, which was almost impermeable to water. Hence soil containing much clay was heavy and difficult to work, remaining wet when soaked, and caked at the surface, allowing the water to descend very imperfectly. Cold and wet places were formed underground when clay existed below a good vegetable soil, and the roots of trees and plants reaching this water were poisoned. Wet clay would contract on drying, cracks forming in it after drought. The changes that prepared a soil for sowing were then checked in such material, or were only enabled to come about slowly. Frost would break up the clods, and sand improve the quality; but a deep clay soil was very difficult to improve. Mechanical admixtures with ashes and soot, as well as with sand, were suitable to such soils. Clays contained much potash, some phosphoric acid, and lime. They would also absorb ammonia and aqueous vapour from the atmosphere, and fix the ammonia very effectually. They were thus regarded as powerful and rich. When slightly burnt they became mellow. In England clay lands had been effectually improved by various methods, and had become extremely valuable and fertile, especially for wheat crops. Drainage opened the way for the permanent improvement of clay soils. Clays were largely derived from felspars. Granite, gneiss, basalt, clay-slate, and other metamorphic and igneous rocks yielded little else than clay soils. Loam was clay mechanically mixed with sand. The quantity of free silica that might exist in a soil without removing from it

the usual characteristics of clay was enormously large. Sand was the least changed of all rocks by weathering. Sandstones were changed by the destruction of the cement that holds them together, but the actual particles changed only by mechanical abrasion. Sand was an accumulation of granules of quartz, lying loosely beside one another, leaving abundant interstices admitting the free passage of water. Water was only retained in sands near the surface in small quantities. Light soils, containing much sand, had a hot, dry nature, giving up moisture rapidly during warm weather, and being readily heated by a summer sun. So again, these soils were active but soon exhausted. When sand was present in an exceedingly fine mealy state it approached clay in its properties, forming a dense compact mass, and holding water. This transition was a very curious fact, and one often insufficiently regarded. Common limestone was a carbonate of lime, exceedingly soft, and readily acted on in the state of chalk, but harder and more stony in the oolites and other building stones. Limestones would work up into soils red in colour, and cracked and broken by weathering near the surface. Magnesian limestone consisted of a carbonate of lime and magnesia, the proportions being variable. It was less capable of supporting abundant vegetation than common limestone. All limestones were permeable to water, and contained a considerable per-centage of it. Chalk was especially absorbent, and acted like a sponge. A calcareous or lime soil was soft to the touch, standing in this respect midway between clay and sand. It would absorb and retain water, but would not become sodden. Its tenacity was greater than sand, but less than clay. It would shrink much less than clay, but would not crack. It would diminish the tenacity and humidity of clay soils, rendering them more porous, more accessible to air, and warmer. Where, however, lime greatly preponderated, the soil was poor and hot; but these characters were readily altered by the admixture of clay and humus. Every soil would support some vegetable growth, much of the difference depending on the mechanical condition of the soil, and much on the chemical composition. Both were due to the underlying rock. To produce a productive soil, in the first place, certain conditions must be avoided. First, too great cohesion. A soil, otherwise productive, might be rendered unproductive if washed by rain into hollow bottoms, where it would cake into a solid, impenetrable mass. Secondly, want of cohesion. A soil might be too coarse, too loose, and too open. Thirdly, poisonous ingredients. This cause was rare, but it existed. The salts of lead and copper were absolutely poisonous in all proportions. Sulphate of iron was also poisonous, and alum might be regarded in the same light. Lastly, the excess of some nutritious ingredients. Thus, common salt was used as a mineral manure, but salt water would entirely destroy vegetation. Mineral acids also interfered with growth, and would destroy vegetable life, if in too large proportion. To make a soil productive, it should possess, first, a soft consistence, unchanged by the operations of tillage. In the next place, the soil must furnish the plant with food essential to its existence in a digestible form. Among the important mineral constituents of a soil were—phosphoric acid, potash, lime, and magnesia. The quantity of these was variable, but the following statement of the limits would be useful as a guide, being given on the authority of Dr. Stöckhardt, a Saxon chemist:—

An Acre of Land, six inches deep, would contain about:—	Maximum.	Minimum.	Mean of predominating Rich Soils.
	Pounds.	Pounds.	Pounds.
Phosphoric acid	12,000	150	2,500
Potash (total quantity).	53,000	1,500	22,000
Soluble potash	15,000	750	3,500
Lime and magnesia ...	145,000	900	30,000

This estimate would show the relative importance of these substances. The most important was phosphoric acid, for without it nourishing food could not be grown and ripened. Of other substances, sulphuric acid must be present, but of it there was generally no want. Silica also was essential and was always present. To learn the proportion needed we must refer to the constituents of the ashes of plants. These would show that some species contain in the ashes of one thousand pounds of dried plants only two pounds of lime and magnesia, half a pound of potash, and only a quarter of a pound of silica. Of meadow grass, however, the ashes contained sixty-four times as much phosphoric acid, thirty-four times as much potash, four times as much lime and magnesia, and eighty times as much silica, as in the case of coniferæ; while wheat contained the same proportion of silica as grass, but much less phosphoric acid, potash, lime, and magnesia. Particular soils were thus favourable for certain crops; forest land that had been so from time immemorial, and was put under another cultivation, was rich; certain soils, unfavourable for particular crops, might once have been the contrary. A productive soil should be composed of nearly equal parts of the three earths—sand, clay, and lime; it should contain decomposing vegetable and animal matter; it should imbibe moisture and give it back to the air without much difficulty; it should have depth sufficient to permit the roots of plants to sink and extend without coming to rock, to water, or to some injurious earth; the subsoil should be moderately porous, and should be able to improve the soil by mixture with it. The proper proportion of the various earths might vary from 50 to 70 per cent. of silicious matter, 20 to 40 per cent. of clay, and 10 to 20 per cent. of calcareous matter. The earth would bear a constant succession of crops of the same kind, if the mineral ingredients removed by one crop were supplied in the same state from year to year. But this could only be done as the result of a nice calculation, and by careful and systematic farming. As a remarkable instance of the successful use of mineral manures in rendering an ordinary soil capable of bearing, the lecturer quoted the experiments carried on at Rothamsted by Mr. Lawes and Dr. Gilbert.* The general result was that the average annual yield, without manure, was much the same over the whole period (of twenty years); that where ammonia salts and all mineral constituents were liberally supplied every year the produce of corn increased and that of straw somewhat diminished; and that where an excess of every constituent required by the crop was annually supplied, by farmyard manure, the rate of increase from year to year was not so great during the later as during some of the earlier years. Analyses of soils were very suggestive. The lecturer mentioned the component parts of some extremely rich soils, but he pointed out that few ordinary soils contained within them such great natural resources. Many that were very valuable under careful management and continued culture, would be almost valueless if left to themselves. The treatment that would best succeed in improving a soil must depend on the subsoil, the climate, and the facilities that exist for obtaining at a reasonable cost the required mineral manures. Among mineral manures the most important were those which supply phosphorus and nitrogen to the growing plant or ripening seed. These were especially necessary for food plants. The want of nitrogen was usually supplied by animal manure; but this was costly, and not always obtainable at the right time in proper quantity, and in the best state. Nitrate of potash, or saltpetre, was known to be a highly efficacious substitute, as well as *cubic nitre*—a nitrate of soda, of which very large quantities were obtainable. This material appeared to be the best and readiest means of communicating nitrogen to growing plants. It was now many years since attention was directed to the phosphates of lime from Estremadura, in Spain, and Dr. Daubeney, ac-

* See *Journal R. Agricul. Soc.*, Vol. xxv.

companied by Captain Widdrington, undertook to decide whether it could be economically worked and conveyed to England. They found a bed consisting of several bands of tolerably pure phosphorite. The thickness of the purer part was about 3 feet, and it was traced on its line of outcrop for about two miles, but the distance from any place at which it could be shipped for exportation, and the cost of transport, rendered its existence useless for practical purposes. Other places were mentioned where this substance had been obtained. Limestone and gypsum were occasionally used as mineral manures. Much more usually, marling, manuring with mud, and warping or bringing on the surface muddy water, and leaving it there to deposit a slime, were resorted to. Another important department of practical agriculture was drainage. It was impossible to exaggerate the importance of water, but it was desirable to regulate its application, and remove it when in excess. Drainage performed this by acting both upon and below the surface, and allowing the water to run off by natural channels. The effect of ploughing was to disturb the ground and expose it to the air, but it was not till drain-pipes were laid that the soil could be said to be available for high cultivation. Drainage was chiefly important in heavy clay lands. Geological maps were most useful in regulating draining operations.

TENTH ORDINARY MEETING.

Wednesday, February 8th, 1865; EDWIN CHADWICK, Esq., C.B., in the chair.

The following candidates were proposed for election as members of the Society :—

Edwards, Henry, 53, Berkeley-square, W.
Lambert, Charles, 3, Queen-street-place, E.C.
Runtz, John, Burlington-house, Stoke Newington, N.
Saunders, Samuel, 22, Sussex-gardens, Hyde-park, W.

The following candidates were balloted for and duly elected members of the Society : —

Bonnerjee, W. C., 108, Denbigh-st., St. George's-rd., S.W
Hill, Frederic, The General Post Office, E.C.
Peckett, George, 10, Aberdeen-park, Highbury, N.
Perkins, Houghton, 25, Mortimer-street, W.
Robinson, Noel Hooke, 6, Great Queen-street, S.W.
Rodger, Captain William, R.N., 9, Shawfield-street, King's-road, S.W.
Sancton, Philip, 28, Cumberland-ter., Regent's-pk., N.W.
Smith, Colonel John Thomas, R.E., 27, Cannon-st., E.C.
Stone, George Graham, 78, Holland-park, W.
Sudlow, John J. J., 8, Manchester-buildings, S.W.
Thompson, Thomas C., 42, Belsize-park, N.W., Sherburn Hall, Durham.
Tomline, William, 5, Whitehall-yard, S.W.

The adjourned discussion on the paper, " London Sewage from the Agricultural Point of View," read by John C. Morton, Esq., at the last meeting, was resumed by

Professor VOELCKER, who said he thought the views expressed in the paper of Mr. Morton had reeived the general approbation of all who had given a thoughtful interest to the subject of sewage in its agricultural bearing. They were called upon to discuss it from this point of view only, for although there had been a great many discussions on the subject of sewage, yet he contended that in its agricultural bearing it had not been sufficiently ventilated. People had devised schemes without inquiring, in the first place, into the character of the soil which was fit for the reception of the sewage, and hence resulted such great diversity of opinion as to the quantity of sewage which might be appropriately applied to land, some contending for small and others for large quantities. In his opinion this question could have been settled long ago if the character of the particular land to be treated had been carefully kept in view Some regarded sewage as a universal manure, fit for every kind of soil, and applicable to every kind of crop. Though he was far from contending that sewage should be applied to grass land alone, he agreed with Mr. Morton that this should be its principal application, but there were cases in which he thought it might be applied to root crops, especially to mangel, which, being provided with a very large leaf surface, evaporated a considerable quantity of moisture, and would appropriate to itself a large amount of sewage. But in the first place they had to inquire into the character of the soil which was most appropriate for the reception of the sewage. He knew perfectly well that there was land in England that did not stand so much in need of manure as of thorough deep cultivation; there were soils which had such immense stores of mineral food that it only required to be developed by the application of special manures in order to produce very large and remunerative crops. It was on such rich clay lands, he believed, sewage never had been and never could be applied with advantage. They had clay soils in this country which were ungrateful for every description of manure, but were most grateful for the steam plough, draining, subsoiling, and all other modes of deep cultivation: and the reason why sewage did not answer for those rich clay soils was, because the fertilizing substances supplied to the soil by the sewage were insignificant in comparison with what the soil already contained. Besides, if a large quantity of water was applied, the excess of moisture did more harm than good to the growing crops. With regard to experience in the application of sewage to clay soils, he could name several landed proprietors who were great enthusiasts for the application of liquid manure, and who had constructed large tanks, and had most thoroughly carried out the experiment, not only on grass land, but on root crops, but had generally signally failed. But let them look at the other extreme. They found in some cases soils so poor, that they required large stores of every kind of mineral and organic matter to be supplied, and these were the soils on which, no doubt, sewage might be used with great advantage. In fact, it might be laid down as a rule that the poorer the soil was, the more successful the application of sewage was likely to be. In the case of such soils, too, they were not to use merely what appeared sufficient on calculation, but something like a hundred or two hundred times as much. Let them here again take actual agricultural experience for their guide. They found that on some soils they could raise very heavy crops of turnips by the application of a few cwts. of guano per acre, three or four cwts. of superphosphate, and a moderate dressing of farm-yard manure, whilst on poor sandy soils, 20 tons of farm-yard manure was considered a moderate dressing, being further augmented by a considerable quantity of superphosphate as well as guano. The quantities of manure to be put on the land should thus in a measure be regulated by the character of the soil. They knew they could raise, on moderate land, good crops by the application of a few cwts. of superphosphate and a few cwts. of guano, while on poor soil they required the same quantity of artificial manure, in addition to 20 tons of good rotten farm-yard manure. In this 20 tons of farm-yard manure they had an amount of phosphoric acid that could only be supplied by 14 cwt. of Peruvian guano; or if they wished to supply the amount of ammonia contained in these 20 tons of farm-yard manure, they would have to use 18 cwt. of guano; or, again, if they were to apply, in the shape of guano, the amount of potash contained in 20 tons of farm-yard manure, they would require to use 1½ ton of Peruvian guano; but no farmer in his senses would think of applying even 14 cwt. of Peruvian guano. If half that quantity were used on some soils, it would kill the crops outright. Hence they saw the poorer the soil was, the larger was the quantity of manure that should be put on the land, and that the quantity they took away in the crops, when harvested, was by no means an indication as to the quan-

tity that ought to be incorporated with the soil. There were many medium soils on which it would be possible to apply sewage with advantage, but then the quantity ought not to be so excessive as in the case of the poor lands, which would swallow up almost any amount of sewage with profit. These were matters of experience, and he thought, if they wished to make the best of London sewage, they ought to institute a very extensive series of experiments on the application of the sewage to lands of different degrees of fertility. He believed that much good would result if the character of the land were first taken into more consideration than had hitherto been the case. This was the point which he wished to bring prominently before the meeting.

Mr. S. Sidney said, in discussing the question of the application of London sewage to land, two points were to be considered, viz., quality and quantity. The latter was so enormous that it could hardly be made intelligible when expressed in tons or cubic feet, the daily supply being sufficient to cover an area of about 80 acres three feet deep, and that supply required to be disposed of day by day. With respect to the quality, it was not what they formerly anticipated, diluted with merely twelve gallons of water per head, but more nearly with forty or fifty gallons. He thought they were now past the time for theorising on this subject, inasmuch as they had twenty years' practical experience. He found that up to the present time there were nine towns in which attempts had been made to apply sewage to agricultural purposes—Alnwick, Croydon, Carlisle, Edinburgh, Malvern, Tavistock, Rugby, Watford, and Worthing. These towns furnished, upon the whole, the most successful results yet obtained of this application. At Edinburgh, large quantities had been applied to poor sandy soils with great results. It might be that in some degree, as was stated by Lord Robert Montagu, it was wastefully applied, but in the towns he had enumerated the success had been sufficiently great to induce other towns to imitate their example, and, at all events, to get rid of a nuisance if they did not make profits. At Alnwick, which was situated in a district subject to a very heavy rainfall, the system of sewage irrigation had been abandoned by the farmers. He did not consider that an argument against its use, but it rather pointed to the right mode of application. At the outset the application of the sewage by means of the pipe and hose system was generally in favour. The attempt was made to pump up everything; but those who were most enthusiastic in that system had abandoned it in favour of the Edinburgh meadow system, while the application of the sewage had been restricted to grass crops, to the almost entire exclusion of any attempts to apply it to cereal crops. One great reason for that was, perhaps, to be found in the fact that wheat was too valuable and important a crop to the farmer to be made the subject of experiment. With fair dressing and an average amount of rain, the farmer was pretty certain of a good wheat crop; therefore, though the application of sewage to the young crop of wheat would perhaps be beneficial in rare cases, the farmers would not make expensive arrangements for this purpose. Mr. Sidney then read a return of the results obtained in the nine towns he had enumerated, which showed that, in most cases, the application of sewage was profitable, the system most in favour being that of surface irrigation to grass. The hose and jet had been generally discontinued. At Worthing the works were not yet in operation; but they were under the charge of Mr. Rawlinson, who, after great experience in sewage irrigation, was about to apply the sewage of a population of 7,000 to an area of about 400 acres. He had rejected the hose and jet system as an expensive process, from which no satisfactory results could be looked for, and had adopted the open meadow system, applying it to grass crops only. Then, again, on this subject they had the thoroughly practical opinion of Sir Joseph Paxton, whose view was that they must be satisfied with securing a large amount of good out of the application of sewage under special circumstances, without expecting it to be universally applicable. His experience was that he could place the sewage made by 250 persons over an acre of sandy land in a year, and that with very great results as to the growth of plants. Sir Joseph Paxton also stated before the Committee that he had not the slightest notion that small dressings could ever be successfully applied with London sewage. Next, he came to the practical experience of the Earl of Essex, in respect of the sewage operations at Watford, who, in his evidence, stated that he began using the sewage of Watford under the impression that that would be sufficient to irrigate 210 acres, and he underpiped that area of land. The quantity of sewage he obtained, however, was about 60,000 or 70,000 tons a year, and this he now applied to only 10 acres of Italian rye-grass and 35 acres of meadow grass. He put 5,000 or 6,000 tons a-year to each acre of Italian rye-grass, and 600 tons on each of the 35 acres of meadow. After hearing such opinions as these, he (Mr. Sidney) thought they could place but little weight on the opinion expressed by Mr. Walker at the last meeting, that 720 tons a year per acre was a proper application of sewage—an opinion with which Mr. Walker's tenants entirely disagreed. On this subject they had also heard the opinion of his friend, Professor Voelcker, than whom no man more possessed the confidence of the farmers of England. Without disrespect to Mr. Walker, he might say that his absence from this country during a great part of the time these experiments were being made at Rugby, did not qualify him to give an opinion which was entitled to equal weight with those of the practical men whom he (Mr. Sidney) had quoted: and two of Mr. Walker's tenants had told him personally that they regarded the small application of sewage as of no use whatever. Again, Lord Robert Montagu referred to the evidence of Mr. Mechi in favour of small dressings in opposition to what his lordship regarded as the profligate employment of sewage on the part of Mr. Lawes, but he (Mr. Sidney) challenged any one who had visited Mr. Mechi's farm to say that any instance was there shown of the value of liquid manure; because, he ventured to say, Mr. Mechi had never grown a good crop from his liquid manure solely—he had been obliged to use solid manure as well. There was another distinguished name he might mention, viz., Baron Liebig, who had written a letter in the newspapers, telling them that after twenty years' experience on the subject of sewage manure, they were all wrong, and that good farming could be only obtained by small dressings. Now, although Liebig was a celebrated man, and a great chemist, he had never yet meddled with a practical question without being entirely wrong. Twenty years ago he denounced deep drainage for cereal crops, and recommended the introduction of a mineral manure that was to grow all sorts of crops, but it had been a failure. Since then he had informed the world that the system of farming pursued in this country had entirely exhausted the soil. He (Mr. Sidney) asked the farmers of England to be guided by the experience of practical men, such as he had referred to, rather than by the theories of enthusiasts. The view taken by Mr. Morton, as to the best mode of using London sewage, was, he thought, that which would bring as much profit as they could expect to derive, while relieving London of a great nuisance.

Dr. Gilbert said, having had a great deal to do with the Rugby experiments, he begged to be allowed, in the absence of Mr. Lawes, to say a few words in reply to what had fallen from Lord Robert Montagu and Mr. Walker at the last meeting, and also in reference to Mr. Morton's statement as the result of his observation of the Rugby operations. Mr. Morton had stated that, in passing over the fields, he saw one in which there was good sweet herbage, which had been fed off, and in another coarse, couchy grass, which had been mown. Now it was quite evident that Mr. Morton had not been informed of all the facts, or he would not have given the two different modes

of removing the crops as the sole reason for the difference in the character of those crops. The meadow which had been fed off had not received 1,000 tons of sewage annually, and had not supported one-third the stock that the more highly-sewaged and coarser herbage had done, whilst it had received repeated dressings of sewage, and the other none, during the whole of the excessively dry summer of last year. With regard to the change of herbage, it was well known by those who had had the largest experience in Edinburgh, that when they had sown fifteen or twenty different kinds of grass, in a few years, if the meadows were successful, and they gave large crops, they reduced them down to two or three plants, and they could not help it. It was, to a great extent, a question of quantity *versus* quality, and if the object was a large produce per acre, they conld not have the complete herbage of a natural feeding pasture, and no one need attempt to get it. But Mr. Walker, in his evidence before Lord Robert Montagu's Committee, gave a statement as to the rules of action in the conduct of the Rugby experiments, and he (Dr. Gilbert) begged to state that both the rules and the practice were the precise contrary to those which were stated by Mr. Walker. Mr. Walker stated in his evidence that "there was a preconcerted system of watering certain plots at stated times, without reference to those times being just the suitable times for watering the grouud. For instance, there were three plots in each field, and they were to be watered *seriatim* at given times, without reference to whether the grass was just then ready for watering or not. The grass was allowed to grow extremely rank, till it was quite dead at the bottom; then it was cut, and the dry stubble-like stalks left to dry a considerable time in the sun; then, and not till then, it was watered again, and took a considerable time to revive." Mr. Lawes being asked if he agreed with that statement, replied, "I do not say that such a thing may not have happened in the course of the last two years and a half, &c." Now he (Mr. Gilbert) would put it to any gentleman connected with agricultnre whether it was possible to sewage any considerable portion of land and have no patches of overgrown crops at times? But on the strength of Mr. Walker's statement, and of the candid admission by Mr. Lawes, that the thing had occasionally happened, Lord Robert Montagu, in his remarks in that room last week, had stated that such was the prearranged rule in the conduct of the experiments. His lordship said, "not only was it wrong from the quantity of sewage put on it, but also from the precise rules which were laid down by Mr. Lawes himself, viz., that at such and such times the sewage was to be applied, and at certain periods the grass was to be cut. The grass grew very long and rank, and rotted at the roots, but Mr. Lawes did not cut it because the prescribed time had not arrived. At last the haymaking time came, and the grass was cut and carted away, while the rotted roots were left to bake in the hot summer sun. The land was parched and cracked, and all the grass worth having was killed." He (Dr. Gilbert) begged to say that, as to the alleged rule of the application of the sewage, there was just some plausible foundation in fact, but as to the alleged rule of cutting, there was none whatever. First, as to the rules of application of sewage. Looking to the fact that the supply of sewage was constant all the year round, and must be disposed of in the winter as well as the summer, it was arranged to apply the quantities fixed upon for each plot, within certain limits, evenly over the year, those limits being entirely dependent on the condition of the grass, always supposing that there was a supply of sewage to be had, which was not always the case, and this was no fault of the Commission. He (Dr. Gilbert) visited those fields during the period of active growth every few weeks, and it was his duty to get an exact record of the amount of sewage applied up to that date, and according to the state of the growth to give directions as to the quantity that should be applied during the next few weeks, so as to give as far as possible the quantity they should receive in summer, at the most advantageous period for the grass. The rule was not to apply sewage when the grass was nearly ready for cutting, and to apply it again immediately the plot was cleared. But it had so happened, more particularly just at the entrance of Mr. Walker's field, where everybody saw it, that the land in that field, being in high ridges and very steep, it had been found very difficult to get the sewage on evenly, although a man was constantly employed in the field to secure that result; portions of the plot had grown very high, while the remaining portions were unfit to cut. Everybody knew that with the exercise of the utmost care it was impossible to get the sewage quite evenly on land so laid out, and that the result must be inequality of growth. From this accidental cause, therefore, it had occasionally happened that the grass on comparatively small portions of a plot had been allowed to remain longer than was otherwise desirable, because the rest of the plot was not fit to cut, and the sewage could not be applied again until nearly the whole was cleared. He therefore begged to repeat that the rules laid down, and practice almost uniformly followed, both as to the application of the sewage and the cutting of the grass, were precisely the contrary to those stated by Mr. Walker in his evidence, and by Lord R. Montagu at the last meeting. His lordship had also endeavoured to give the meeting the impression that Mr. Lawes' practical recommendation to the public was to apply as much as from 60,000 to 70,000 tons of sewage per acre, and his lordship put it to the meeting what was to be thought of the opinions of a gentleman who recommended from 50,000 to 70,000 tons per acre? and in contradiction to this his lordship quoted the statement of Mr. Walker, that on an average he only applied 750 tons per acre. Now Mr. Lawes had, in his evidence, about half a dozen times, distinctly stated that so far as his experience went, about 6,000 tons was the proper amount to be applied to grass land; but after giving that evidence over and over again, he was asked a question by the committee as to what he would do provided he had an unlimited supply of sewage for nothing? to which his reply was—"If I could have it for nothing, and put it on the ground, I would use 50,000, 60,000, or 70,000 tons per acre, or anything you could give me." It was, then, not as Mr. Lawes' recommendation to the public, as Lord Robert Montagu had with such want of candour endeavoured to persuade them, but simply with the view to getting the greatest possible produce per acre provided he were to have the sewage for nothing, that he said he would under those conditions use so large an amount. The following quotations from his evidence showed what was Mr. Lawes' practical advice on the point:—

4562. "I should think that, perhaps, 6,000 tons would be as much as I should wish to use upon an acre, if I could get a suitable district for it."

4565. "I should think 6,000 tons per acre, but it depends a great deal on a number of circumstances, &c."

4567. "Looking to the interest of both parties, I should say about 6,000 tons per acre; as a tenant, I should say 30,000 or 40,000 if you gave me the sewage. If you wanted to charge for it, I should confine myself to something about 6,000."

In conclusion, he (Dr. Gilbert) would ask, what would be the benefit to the ratepaying and urban populations of such unfair representations of evidence on this great question. He would ask, why Mr. Walker, the landlord at Rugby, was examined, whilst his tenants, the men who had lost the money on the small quantity and large area system, were not examined. The evidence of a farmer tenant had, it was true, been taken, and he, being a grazing farmer, and having lost much money by his sewage farming under Mr. Walker, his testimony was that sewage was not good for either grass or arable land. But neither of the present tenants (one of eleven years' experience) had been examined. Mr. Campbell being accidentally at the House on one occasion,

Lord R. Montagu offered to examine him if he wished, but it was for the chairman (Lord R. Montagu) to wish, and not for the witness, so he was not examined. Whatever use might be made of facts and evidence, and whatever schemes might be propounded, unless it could be shown that it was to the interest of the farmers to use the sewage, they would never be customers for it. The subject was essentially a practical one, and practical considerations could not be ignored; and he (Dr. Gilbert) was confident that if sewage could not be delivered on the land at an average of considerably less per ton the year round than had been proposed by sanguine and theoretical persons, the farmers would not use it, and nothing but loss, disappointment, and further postponement of the settlement of this question would result.

Mr. Alderman Mechi said, to a certain extent, they must look for the same descriptions of prejudice on the sewage question as existed in the early days of gas and railways. It might be said to be the great question of the age, because it was quite clear the food of the people of this country depended on properly putting upon the soil human and animal excrement; and if he differed from gentlemen who advocated large applications of sewage to land, it was on this principle, that they had it in evidence that the farmed land of England, in its present form, received the excrement of about two sheep to the acre, and therefore when a sudden jump was proposed to what was equivalent to two or three hundred sheep per acre as the manurial provision it astonished farmers very much. Then there was another view of the question. If his calculations were right, it required the produce of 6,000,000 acres of land to feed the 3,000,000 population of London. It was true they had the difficulty—or what was said to be a difficulty—to deal with, that the manure contained in sewage was mixed up with a very large amount of water, and there naturally arose the question—first, whether the conducting of so large a mass of liquid to the land could be practically carried out with a profit; and, secondly, whether that additional quantity of rainfall—so to call it—would be injurious to the soil? The evidence of eminent hydraulic engineers was that they could raise 1,000 tons of sewage 300 feet at a cost of 13s. to 14s. If they applied that test to the cost of raising the whole of the sewage of London, he could not make it come to more than £500 per day. Now, if they were to believe Liebig, he told them, in his recent paper, that the sewage of London was of the value of £12,000 a day. Baron Liebig had recently addressed a paper to the Lord Mayor of London, for which the thanks of the Corporation would be voted to him, which appeared to exhaust the question as to the value of sewage and the most profitable mode of using it. Arguments had been employed against applying it to certain soils. His friend, Professor Voelcker, said some qualities of land required a great deal and others wanted very little of it; but if they looked at the area of 6,000,000 acres which he had referred to, they would find that nine-tenths of it was so poor that it would bear a double and treble supply of manure. But what did they propose to do on the principle of large applications? It was proposed to denude the great area of the land of the fertility which had been exhausted by the crop, and spread it over a smaller area in the immediate vicinity of the town. He cared nothing for any of the great rival schemes, but he spoke of this only as a great national question. Then came the question whether sewage was best for one crop or for another. The notion seemed to prevail at present that it was almost exclusively adapted to the growth of grass crops. But what did Liebig say on the subject? He said it was a great mistake to put it on grass crops at all, inasmuch as it supplied a large amount of fertilising properties which were not required for grass, but which would be of great value to cereal plants. Mr. Sidney had said that he (Mr. Mechi) knew nothing about sewage! Why, for fifteen years he had put all the excrements of his animals and the sewage of twelve people in his house on his land, and if that, mixed with large quantities of water, was not sewage, animal and human, he did not know what was. The great mistake that had been made was applying sewage to slow-growing fine grasses in large quantities, when it should have been applied to rapidly-growing grasses of good quality. Italian rye-grass after sewage was so rich that they did not dare to give a full supply of it to young animals because it would kill them. He had lately had some calves die, and Professor Symonds told him the reason was the extreme richness of the Italian grass on which they had been fed. A practical farmer might regard the long, rank, strawy-looking hay from Italian grass as very poor stuff, but the men who fed horses and fat bullocks upon it said they had never seen their animals in such condition, even when they had the best clover hay, or the best meadow grass. This Italian rye-grass, which was a rapidly-growing grass, was particularly suited to large applications of moisture, for in the dry Midland, Eastern, and Southern counties, where there was not much rain, those who attempted to grow Italian rye-grass never got a second crop, because it absorbed and evaporated such a large amount of moisture; and he could understand perfectly what had been said by Dr. Gilbert, that the application of a large quantity of sewage would produce plants adapted to that large application, for by changing the application they changed the plant; the extent of moisture applied would actually regulate the kind of grass produced. He congratulated the Board of Works in having taken active steps in this matter, and the Society of Arts on the present discussion. It might take some time to settle finally the best mode of applying London sewage with profit and with good results, but in the meantime what he would guard the Board of Works against, was the parting for ever with that which they knew to be valuable. When such a man as Liebig stated the sewage of London to be worth £2,000,000 a year, minus the cost of application, it was a great mistake to give that valuable property away, except for a limited time and under certain conditions. The whole subject demanded serious attention, affecting as it did, not only the ratepayers, but the general interests of the country.

Mr. Robert Rawlinson said he did not like to venture to say much on this subject, because he did not profess to have any intimate knowledge of agriculture, but it did so happen that he had had a pretty wide experience in the examination of districts where sewage works were being constructed, and where sewage application had taken place, and he had also necessarily paid some attention to the schemes which had been propounded for the application of the sewage of the metropolis to land. He had only a few minutes ago heard it intimated, by so high an authority as Mr. Alderman Mechi, that there was a probable advantage to arise to the metropolis in applying its sewage to large areas for agricultural purposes in small dressings. He could only say that, at the present moment, all the knowledge he possessed, and all the experience that had come to him, were in a directly contrary direction; and he also held that if large sums of money were raised by a company, and if the large works planned were attempted for the application of the sewage of the metropolis over hundreds of thousands of acres, he thought that it would only result in bankruptcy. To carry sewage over large areas necessarily involved two things, very expensive lifting power, and very expensive permanent plant below the surface for the so-called distribution. Where the application of sewage had been a success he found that it was in cases where it had been applied in large dressings, in the simplest possible manner, over comparatively small areas, with no price paid for it, and with very simple apparatus. In Edinburgh there was a very limited area, about 400 acres, receiving the refuse of a considerable portion of the city, which came down without any cost, without any fettering conditions as to how, when, or in what way it should be used. The

greatest possible results were thus produced from the land so treated; but in the town of Leith, clear-headed, calculating Scotchmen were going to expend £66,000 in sewering the Leith district; and in the face of a rental of £35 an acre on the opposite side of the city, they were spending this large amount of money to carry the pipes on to the sea that the sewage might there be discharged. If any one thought they were wrong in this, and would like to take the sewage and make use of it, he (Mr. Rawlinson) would be happy to place him in communication with the Corporation of Edinburgh, who would be only too happy to let him have the sewage for nothing. Surely there was something in this, in spite of what Alderman Mechi had said about the necessity of taking the sewage back to the land. Was there no escape from the dilemma otherwise than committing themselves to an extravagant expenditure of money which would not be remunerative? How long would a scheme of applying sewage be carried on if it did not pay? They might manage by some means or other to utilise the sewage in a profitable manner, but to say that the sewage of London, which was the produce of 3,000,000 of people, should be applied over 6,000,000 or even 1,000,000 acres, was an absolute fallacy. In his opinion no such system could be carried out. Then, again, with regard to the mode of applying sewage, he would give them in a rough way the amount which it would cost to pipe the whole area. In round numbers, the cast-iron pipes they would have to lay down would cost a shilling per inch in the diameter for a yard in length. If they took the greatest and most successful examples of irrigation of which they had any knowledge, where large volumes of water had long been regularly poured over the land, producing really great results, such as in the northern parts of Italy, and in some parts of India, they would find that the whole of the water was distributed by canals, open carriers, and open runnels. It might be said that this was water, and what they were now dealing with was sewage, but if they had attempted to distribute the water by underground conduits of cast-iron, the works would have cost 24 times as much as they had done. Lord Robert Montagu had accused him of having given evidence before the Committee which was contrary to his opinions. He could only say that if in giving his evidence he failed to make his meaning clear it was from no dishonest motive; but his own belief was that his evidence and his opinions were in perfect accordance.

Mr. Bowing said he should be glad to accept Mr. Rawlinson's offer to be put in communication with the authorities at Leith, and would gladly take the sewage of that place. As they had heard so often, there were two modes of applying the sewage which were now being advocated by opposing parties, one that of small dressings over large areas, and the other large dressings over small areas. The mode, however, to be adopted was that which would enable the real value of the sewage to be fully made use of, giving the ratepayer his share in this value. For his own part, he believed the sewage was a very valuable property. Baron Liebig and others said that the sewage was worth about twopence per ton. Hofmann and Witt had adopted one method of proceeding, and Baron Liebig another, and yet they all three arrived at about the same result as to the actual value of the sewage. If the sewage were applied in such enormous dressings as 10,000 to 20,000 tons to an acre, as done at Edinburgh, and as proposed by Messrs. Napier and Hope, how was it possible to recover one-fiftieth part of its value? Liebig gave it as his opinion that sand was the last soil and grass the last crop to which sewage should be applied. He did not believe that the Board of Works had had the interest of the ratepayers of the metropolis at heart in what they had done, and it would be a source of satisfaction to everybody if that body would only come forward and allow their plans to be tested. All interested in the matter must be glad that Lord Robert Montagu had again taken the subject up, and that there would be an inquiry into all the plans which had been proposed for the utilisation of the sewage, entirely without the assistance of the Metropolitan Board of Works.

Mr. Harris said there was one point which they seemed to have lost sight of, and that was that the Metropolitan Board of Works required the sewage to be taken away so as not to be a nuisance. Taking the sewage of the northern part of the metropolis at the quantity stated, it would be found that if it travelled at the rate of a mile and a half an hour, it would occupy a channel of something like 20 feet wide and 6 feet deep. Here was a small river constantly coming down to be provided for, and which must be dealt with as it came. This was a fact which materially affected the whole question. He would say nothing about the engineering part of the case, but the chemical question was a very important one. It was now generally acknowledged by chemists that the sewage was worth about 6s. per head of the population. It was best to speak of it as so much per head, because if the value per ton were given, the question of dilution entered so materially into the matter that it was impossible to get at anything like correct results. The sewage of Croydon, for instance, was diluted to twice the extent of that of Watford, and of course the intrinsic value of a ton in one case would be double that which it would be in the other. But what did Liebig say in his letter about the sewage in this diluted state? He said, "In the diluted state in which these elements are present in sewer water they are without any mercantile value." The ratepayers of London were the owners of this stuff in its rough state, and the farmers were the manufacturers who had to get the metal from the ore supplied to them by the ratepayers. As far as experience went, he found sewage so far from returning 6s. per head of the population very often did not give back more than 2s. per head. Liebig rated the agriculturists in his letter for paying twice the value for guano. He told them that they were being deluded by the chemists of the country, and were giving £13 a ton for what was worth only £6 or £7. For his own part he did not believe that the agriculturists of Great Britain were so foolish, and that they would not continue to give such a sum for any article if they did not find that they got a *quid pro quo*. In comparing sewage with other manures, it must be remembered that they could apply other manures when and how they pleased, but they had to take the sewage throughout the year and apply it every day. Sewage was an exceptional manure, and the only persons at all who used manure in a manner analogous to that in which sewage should be used were market gardeners, who, near London, sometimes applied 70 tons of manure per acre to their land, which quantity contained twice as much phosphoric acid and twice as much potash as 7,000 tons of sewage, and about two-thirds the quantity of ammonia. If, then, they looked upon market-gardening as the highest form of agriculture, they must allow that the application of 7,000 tons of sewage per acre could not be considered excessive. Baron Liebig stated in his letter that if a possibility was offered to the farmer to get back as sewage those matters which he had carried as food to the town, that was to say, if he gave his fields the same, both in quantity and in quality, which had been taken from them, their fertility might then be assured to an endless number of years, but was there a possibility of doing this? They had a plan before them by which it was proposed to apply the sewage of the three million of inhabitants of London to about 530,000 acres. If they applied this principle to the whole of England and Wales, the population being about 20,000,000, they would find that the whole amount of sewage would require about 3,500,000 acres of land, whereas the total acreage of England and Wales was about 37,000,000; and thus on the most extensive plan proposed only about a tithe of the whole of the land could receive the benefit of the sewage, and what was to become of the other nine-tenths? Baron Liebig stated that we were now refreshing our land and keep-

ing up our produce by the application of large importations of guano, which supply would very soon cease, and that our land would then go out of cultivation, and we should be reduced to a state of famine. This was a conclusion to which they might fairly come from Liebig's statement. But was there any such fear for English agriculturists? He believed not, for if the supply of guano should fail, he had no doubt they would exercise their ingenuity in discovering some other material which would answer the same purpose.

Mr. WM. HAWES said he quite agreed with the remarks of Mr. Alderman Mechi as to the great advance which this question had made, and he believed that there were plenty of gentlemen to be found in England who would take the matter into their consideration, and, after they had formed their opinions upon it, would support those opinions by their capital. In this way experiments would be made, and in the course of a few years he had no doubt that they would arrive at the solution of the problem, and would find out the best mode of applying sewage to the land. He did not believe that they would much longer neglect the great lesson which Providence had taught them, that of returning to the soil that which they had previously taken from it, and enabling it to reproduce the same materials. It was a question which required time, science, and capital. They must not disregard either of these, and if at any time, even during the present session, any new information could be obtained, or old information be supported by new arguments, the Society of Arts would be very glad to give an opportunity for re-opening the subject.

Mr. STUART BARKER, after expressing his satisfaction at hearing Mr. Morton's valuable paper, and alluding to the various schemes which had been proposed, said his own experience led him to the conclusion that the best means of applying sewage was by ordinary irrigation, and that by this method they could obtain a maximum result at a minimum of cost and labour. He had applied the sewage on a farm by means of a hose and tap, and scarcely any beneficial result had followed, but he afterwards cut an open drain and the result was immediately perceptible in the increased quality and crop of grass. If they were to commence the work again there was no doubt that some improvement might be made, but it must be recollected that the sewage of London was now at Barking, and that it could not be brought back, but must be dealt with under existing circumstances. If it was not allowed to go into the river as at present proposed, then it must be carried farther down the river. There was no reference in the paper to the application of sewage at Carlisle, where the experiment had been highly successful. A mode of deodorising the sewage, and applying it to the land had been adopted. The population was about 22,000, and the sewage was applied to 70 acres. During the last 30 years we had been violating the natural law, that what was taken from the earth should be returned to it again. Of late years, instead of putting the refuse of our towns on the land, we had thrown it away into the rivers, where it had been prejudicial in every respect. The connexion which necessarily existed between the application of sewage and the drainage of land, was most important. If sewage was to be applied in quantity, the land must be thoroughly drained in order to carry off the water, and unless this were done we should, by the frequent application of large quantities of sewage, convert our meadows and lowlands into so many marshes and bogs. But in many cases, where there was sufficient fall, and the pipes were large enough, the drains might be made to answer the two-fold purpose of draining the land and of conveying the sewage to any part of a field where it might be required. This might be accomplished by connecting the upper end of the drain (covered by a grate) with the carrier or feeder, and by means of plugs and spout drains, placed at intervals, the sewage might be thrown alternately over various portions of the land. The advantages of this plan would be that sewage would be economised, and that the land at the lower end of the field would not receive the sewage which had already passed over the upper portion, and which had therefore lost much of its fertilising power, but would derive its supply fresh from the drains. We should not then see, as we frequently did now, a luxuriant crop at the upper end, and a deficient one in the lower part of the field, but the crop would be equally good throughout. In many positions, too, hydrants and hose and jet might thus be dispensed with, and the whole plan could be carried out by a small addition to the ordinary cost of drainage. This, he might say, was not a mere theory, but a plan which he had adopted in water meadows with success. He was glad to see that Lord Robert Montagu was again going to bring forward in Parliament the subject of the application of town sewage.

Dr. BACHHOFFNER said that the appointment of another committee to inquire into this matter was the very last thing he should like to see, if it was to be such a committee as they had had before. The two schemes proposed reminded him of the opposing systems of homœopathy and allopathy, and his own experience led him to prefer the allopathic course of treatment—he preferred large doses of manure to small areas of land. As had been said, the sewage of London was already at Barking, and could not be kept there, but if the small dosing system were adopted, they would be obliged to deodorise it there, and turn it into the Thames. When they considered the millions of money which Londoners had spent to take the sewage to Barking, was it common sense to spend millions more to have it brought back again? In his opinion no system could be successful which did not use every atom of the sewage at such a distance from London that it should not be a nuisance to the metropolis. A great deal had been said about the value of London sewage, but the experiments which had been made by Dr. Hofmann and Mr. Witt had no value as regarded London sewage. The analyses were quite correct as far as they went, but they did not go far enough.

The CHAIRMAN said that, at that late period of the discussion, he should only enter into the subject to correct some grave misapprehensions. Mr. Walker had stated that the General Board of Health, or had implied that he (the Chairman) had at the outset recommended the application of a certain quantity of sewage—5,000 gallons per acre. He had made no recommendation of the sort. What he had done with the principle from the first had been to recommend trial works on every occasion for its application, both on account of the great diversity of soils (as noticed by Professor Voelcker), as well as of the various crops. Then, again, the kind of sewage, and the extent of its dilution, were matters of importance. In writings, and in this discussion, sewage manure had been assumed to be very much of one quality. In one town, however, the supply was at the rate of 300 gallons per house, the greater part of which was waste, (at Croydon, for example,) whilst in another on the constant system, the supply was not more than forty gallons per house. Then, again, no care had usually been taken as to the sort of soil-pan or water-closet introduced to ensure the least quantity of water being used for cleansing and conveyance, and consequently for dilution. In some, half a gallon of water sufficed, in others two gallons or more were used. Instructions had early been given to intercept sewage from old natural water-courses, and to prevent subsoil water, or surface water, getting into the sewers, sending the rainfall proper from the uncovered portions. In London, under a proper system of engineering, the old natural water-courses, the Old Bourne, the East Bourne, the West Bourne, would have been restored to their natural functions, and storm-waters would have been conveyed to the river through them; instead of which they had been treated as sewers, and made to discharge storm and subsoil water into most expensively and unnecessarily enlarged intercepting sewers. Hence the

condition of the sewage in the dry weather flow, in wet weather, and in storms, was widely varied. In one condition it would be valuable, in another so diluted as to be comparatively valueless. It had yet to be taught that internal care as to the adjustment of the apparatus for its collection and removal, was needful to preserve it in the best condition for its regular and efficient application. Again, by most chemists even, no distinction had been made of the wide difference between fresh and putrid sewage. Yet the difference was extreme. Professor Voelcker had proved, that throughout the country the farmers wasted full one-third of the farm yard manure by not using it fresh. The difference in efficiency between fresh and putrid sewage was even greater. The matter contained in the water discharged as sewage from London was generally a year old at least. It was the disintegrated matter, the overflow of cesspools, or of badly constructed drains of deposit, or sewers of deposit, of which there were some hundred miles in London, constantly giving off effluvia, wasting manure in houses and streets. People complained of the pollution of rivers; where putrid sewage from old town sewers was disharged into rivers it killed the fish; where fresh sewage was discharged it appeared to feed them. At Carlisle, which had been newly drained with pipe drains, it was stated that the fish greatly increased in quantity and improved in quality. At Ely, also, the anglers found their best sport at the mouth of the pipe sewers. So much for the consolation of those who were more anxious for the preservation of fish than for the population of towns. But there was a better use for sewage than feeding fish. In this diversity of the conditions of sewage he had always advised that all outlays should be preceded and governed by trial-works, to determine the extent of land that would absorb a given quantity in ordinary conditions. They should make the trials by the water-pot, or by the water-cart, in measured quantities, to see how much the land, with and without vegetation, would absorb and retain without letting any run off or run through at each dressing. Having thus ascertained the maximum quantity which the particular soil and vegetation would utilise, the next question to consider was, the most economical means of bringing the sewage to the land and distributing it. Iron pipes usually cost about £5 an acre. In some cases, where the ground had a natural inclination, as in Devonshire water meadows, they were laid out for less than that, but in general the water meadows cost much more to form; at Edinburgh they cost more than £16 an acre, and some of the Duke of Portland's water meadows, near Mansfield, cost as much as £100 an acre. In Lombardy, even, they often cost as much as £40 an acre; people had visited and looked at such places without inquiring either into the original outlay or the working expenses, and talked of the easy and natural flow of the water, without considering how much of it flowed away unapplied, which was commonly more than half. On some of the Edinburgh meadows the very rent of the space occupied by the sluices and carriers would, it had been declared, pay for the rent of the pipes and the expenses of distribution by steam power, by which, if properly conducted, as great an effect would be produced with one-third the quantity of sewage. If, however, those who had adopted steam and pipe distribution, whether for farm or town manures, had been guided, as they were generally advised, by previous trial works, they would have found that with high cultivation (which was the cheapest) one-half, or even one-third, of the pipeage or area of land would have sufficed. Trial works, well conducted and well observed, would settle the chief controversies raised. The persons to conduct such works should not be mere practical farmers; but the persons best qualified to work the land on such trials were market gardeners; and they should be guided in the application of the liquid manure by horticulturists who grew prize fruits, who were accustomed to the feeding of plants, and practically acquainted with the applications of liquefied manures, and who knew the right times and seasons for applying repeated doses to stimulate growth. In such hands far different results would be produced than those described in Mr. Morton's paper. When he was in Paris some time ago, he had the honour to speak to the Emperor on the subject, when he submitted that his Majesty's officers ought to conduct for themselves trial works for dealing with the sewage of Paris; they did so, and impartial persons would acknowledge that these trials were the best that had been made; they were conducted by Professor Moll, of the Conservatoire des Arts-et-Metiers, assisted by Mons. Mille, ingénieur-en-chef of Paris. These gentlemen, with others, came over to this country, and examined for themselves the chief works, at Watford, Leicester, and Rugby, the liquefied manure farms, and the Edinburgh irrigated meadows. They decided against the application of sewage by the method of submersion, and adopted in preference the method by steam and pipe distribution. Mr. Morton had written an English Encyclopœdia of Agriculture, while Professor Moll, who occupied an analogous position in France, had written a French Encyclopœdia on the same subject. He was, moreover, eminent as a practical agriculturist. He had conducted an experimental farm for the application of the sewage of Paris, and on this he had written a very able paper, embracing the whole subject of the application of the sewage of towns to agricultural production. Ill-health had obliged him to quit the farm, but he had recently written a letter, in which he had said that a practical experience for five years had made him more and more a partisan of his (the Chairman's) system of distribution, as the best means of applying the sewage manure of towns to land.

Mr. Walker (of Rugby) wished to say a word or two in explanation. About 12 or 13 years ago, he and others had been led, by the report of the Commission, to believe that 5,000 gallons per acre was a fair quantity. This opinion was founded upon the reports of the various engineers who had inspected the works then existing in different parts of the country. The results varied from about 2,800 to 6,000, and, therefore, 5,000 was taken as being about a proper quantity.

The Chairman said it was now his pleasing duty to propose a vote of thanks to Mr. Morton for his valuable paper. He was sure they would all tender their thanks to him.

The vote of thanks having been passed,

Mr. Morton acknowledged the compliment paid to him.

Mr. J. Bailey Denton writes:—As I had no opportunity, on Wednesday evening last, of saying a few words, and shall be absent on Wednesday next, I will ask you to insert the following remarks upon two points which I think have not received the attention that is due to them. In the first place, the full development of town sewage, as now practised, is dependent upon a copious supply of water, and a complete extension of the water-closet system, and, therefore, the supply of water to towns is a matter of the highest moment. It follows, upon this admission, that every town should not only look out for itself to have a sufficient quantity of water, but that it should not dispose of its own sewage in such a way as to injuriously affect the water supply of other towns. Now, if we study the regime of our rivers, it will be seen that their flow depends upon the tributary influx of waters which are now being used, and will be used to a greater extent every day, by towns; and that if that use is to be converted into an abuse, by entire abstraction, if not by pollution, the question arises which of the two is the greater evil. To apply this question to the present discussion, we have only to suppose that the effect of irrigating land with sewage is to absorb the whole by vegetation and evaporation, which will certainly be the case if the

irrigation takes place between April and October. What, then, is to become of the rivers which lose this water? Depend upon it this is a great and important point, and that any mode of dealing with the sewage of towns which has not regard to the water economy of the country will not be a lasting one. In the case of tidal rivers, like the Thames at London, it may be out of place to refer to this, but we must remember that what is done in London will be taken as an example for all other towns, and that the water question in its several aspects is one inseparable from sewage. In the second place, I wish to draw the attention of the Society to the fact that great efforts, by highly scientific men, in France and Germany, are now being directed to such a modification of the water-closet system as shall separate the water, in a great measure, from the excrement, so as to allow the one to return, innocuous, to rivers, and the other to be arrested in such concentrated condition as to be really serviceable as manure. This separation is effected in the water-closets by having a pipe to receive such surplus water as is not required for lubricating the excrement-pipe, and conduct it away into the sewers, while the excrements themselves are conducted by another pipe into tanks, from whence, having been purchased, they are removed. Mons. Mosselman, of Paris, has an ingenious plan of using quicklime so as to absorb the fluid excrements, and thus he converts the urine into solid without the loss of the ammonia. Though I cannot say that this mode of treatment is at present applicable to London, where a system of sewerage has been established inconsistent with any separation of the valuable part of the sewage from the bulk, yet I can well understand that the French plan is applicable to towns not yet sewered; and I know of no reason why householders should not withhold their sewage from the sewers if they can sell it, and thus the value of the bulk discharged by the sewers will be reduced. What, then, will become of those works which depend for their success on the value and utilization of the whole discharge of towns? I put these questions thus categorically because I feel that although the pollution of our rivers calls for immediate consideration, the abstraction of water never to return to the rivers is a matter of equal importance, and that any application of science which will allow of the return of the water into the rivers, after the valuable ingredients of sewage have been appropriated, is the object to which we ought to look, and not, in our hurry to get rid of a troublesome matter, take it for granted that science will never discover some means of adjusting the question to the requirements of all interests. To render my note apposite to the discussion, I should state, as immediately bearing upon the sewage of the metropolis, that some years back I investigated the Essex Marshes, and am enabled to state that at least 9-10ths of their extent must be under-drained before they can be profitably laid out for irrigation; and, I may add, as a fact capable of proof, that to irrigate the marshes of any low-lying valley is to increase its unhealthiness, though that may be greatly mitigated by under-drainage. I do not lay stress upon the increased evil of irrigating with sewage instead of water, as it must be manifest to everyone that miasma, which is due to the deleterious matter evolved with water under the influence of the atmosphere, is more likely to arise from the putrid matter of the London sewers than from the clearer waters which are generally used for irrigation. At this time I am engaged in superintending the conversion of water meadows in a well-known valley into dry meadows, because they are found unhealthy; and it seems the reverse of discretion to make the wet meadows in the metropolitan valley still more wet by irrigation, and apply sewage for the purpose, when the neighbourhood is already known to be subject to fever and ague.

Mr. WALKER, of Rugby, writes:—The great pressure for time last night prevented my replying to Dr. Gilbert, though I could only repeat, on the evidence of my own sight and that of all the neighbourhood, that the land was treated in the way I had described—not in places here and there, but the whole of it—and systematically. Dr. Gilbert cannot deny that the sewage was running off one part almost unchanged, while other parts were thirsting for it, one part being flooded while another part was baked. He does not and cannot say that the waterings were regulated so as to follow immediately on the mowing. He does not and cannot say that the grass was not left lying in masses on the ground long after it was fit to cut, and when it was quite white at bottom. He cannot deny that the reason given for such delay in mowing was that the regulation cows kept to test the feeding and milk-giving quality of the grass were not ready for it. I went on the land time after time, and always found the same thing, and Mr. Campbell (employed to see to the measurements, &c.,) told me the days fixed for the various waterings. It is true these waterings could not always be given for want of material, but this only made bad worse. Mr. Morton did not describe the herbage as spoilt in isolated exceptional places, but generally; and if anyone entertains any doubt, the fields are only half-an-hour's walk from the Rugby station, and may be seen at any time, and they would carry the conviction that there is not the slightest foundation for Dr. Gilbert's assertion that it is only in exceptional places that the good herbage was destroyed.

Mr. JOHN BETHELL writes:—As this is a subject which I have for years studied as a manufacturing chemist and as a farmer (having farmed a large farm), I venture to send you my opinions. It is an established fact, that if you return to an acre of land the excreta of men or animals that have eaten the produce of that land, you will not only retain the land in its fertility, but you will increase this every year, because the land will absorb from the atmosphere some extra fertilizing properties beyond that furnished by the manure, so that under such circumstances it will increase in its fertility. This has been well proved in China and Belgium, where the most careful attention has been paid to the subject, so much so, that in Belgium, domestic servants on being hired reserve to themselves the power of selling their excreta, which was generally contracted for at £1 per annum, and of course it must be admitted that if the excreta of the inhabitants of London could be collected and applied to the land, as was done in Belgium, a large annual value would be derived thereby. Professor Liebig values it (I believe) at 6s. per head. But this is in my opinion surrounded with immense difficulties, when applied to London sewage. Chemists are too apt to look to the important facts above stated, without sufficiently considering the different circumstances under which London sewage is collected. The excreta of a human being, valued by its solid particles, does not exceed 1 lb. per day, and by the provision of our water supply to houses this is mixed with thirty gallons of water per head, or 300 lbs.; but this is not all, because you must add to this the washings of the streets, which will increase it to 400 or 500 lbs. of water to one lb. of excrement. Now we know, as chemists, that if this mixture remains for some days before it is distributed on the land, the animal matters putrefy, and give birth to ammonia and soluble phosphate, which are dissolved by the water, and held in suspension by it, so that all the manuring properties are in the water, and the solid contains none; and as we have only the ammonia and soluble phosphate generated from 1 lb. of excrement mixed with 400 lbs. of water, such solution will be so very weak, that unless it is applied in very large quantities it will be of little service to the land. And then you must consider that in doing this you must cover the land with an enormous amount of water, which in many cases may be detrimental. The beneficial results obtained by Alderman Mechi and others were realised under different circumstances. Their liquid sewage did not contain anything like the extra quantity of water which exists in London sewage

There is another great difficulty, which I think the Board of Works will find to be a most serious inconvenience to them, and a matter of enormous expense. They propose (I understand) to send the sewage to large tanks at Barking, where it is to remain until the solid particles subside, and then to run off the liquid into the Thames. Now this solid matter will be composed, chiefly, of the débris or small particles of stone, iron from horses' shoes, &c., all of which is utterly valueless as a manure; and it has been proved that no farmers will cart it away, even if it was given to them, as it is not worth the cost of cartage. But what will they do with it? It will soon amount to many thousands of tons; and if it is taken out of the tanks and heaped up it will still contain sufficient impurities to cause a very noxious vapour in the atmosphere, which may be seriously injurious to the health of the neighbourhood. I mentioned this in the Chemical Section of the last meeting of the British Association (1864), and the chemists present agreed with me in thinking that this was a most serious difficulty. If the liquid parts of the sewage of London were separated from the solid, and then by proper regulations, applied to certain descriptions of land, it would no doubt be very valuable, but then how are you to dispose of the sediment, or solid particles of stone, iron, &c. I do not think this has been sufficiently considered, but in my opinion it is most important to do so. Then as to the nature of the soil to which it should be applied. Professor Way showed us some years ago that if you filter water containing ammonia, &c., or putrid urine, through land containing a certain amount of clay, the clay absorbs all the ammonia and manuring property in the liquid, and then he stated that nature, by its wonderful chymical power, made from these compounds of clay and manuring properties a nourishing food for plants, but when the same liquid was filtered through sand, or earth not containing clay, the ammonia and manuring properties passed through the soil unchanged, and therefore no food for plants would be produced thereby in that soil. In the former case the putrid urine liquid was collected at the bottom of the filter as pure water, freed from all manuring or noxious smells, but in the latter it passed through nearly unchanged and as stinking as before. Presuming this to be correct, what would be the value of manuring the Maplin or any other sand with liquid sewage; and what profit would be derived by depositing on the sand particles of granite and iron from the London streets? None whatever. If they could mix with the Maplin Sand clay, and then apply liquid manure, a beneficial result would be obtained, but the cost of applying this clay would be great. The late Professor Buckland often stated that Woking Common could be rendered fertile by covering it with a stratum of clay, which he considered could be brought by rail and spread on the land at such a cost as would pay. If this was done, then London sewage distributed over it would be extremely beneficial. I make these remarks with the hope that gentlemen working on this subject will consider them, as, when the objections are correctly known, remedies may be suggested.

Proceedings of Institutions.

Birmingham and Midland Institute.—The programme for the winter term includes lectures on "The Socialistic Schemes of St. Simon and Fourier," by Dr. Hodgson; on "The Relations of Great Men to Women," by Mr. George Dawson, M.A.; on "The Life and Writings of Sydney Smith," by Mr. J. Bickerton Williams; on "The Re-production of Natural Forms by Art and Manufacture, having special reference to Art Metal Work in Birmingham," by Mr. B. Waterhouse Hawkins, F.L.S., F.G.S.; and "A Few Words on English Poets, with Selected Passages," by Lord Lyttelton. Classes in many of the principal subjects included in the Society of Arts Examination will be regularly held. Penny lectures will also be delivered, the subjects being, "Optical Instruments," by Mr. C. J. Woodward; "Natural History," by Mr. B. Waterhouse Hawkins, F.L.S., F.G.S.; "The Human Body, its Functions, and How to keep it Healthy," by Dr. Alfred Hill; and "Colours, their Appearance in Nature and Production by Art," by Mr. Alfred S. Johnstone.

Sheffield Literary and Philosophical Society.—A conversazione was held in the Cutlers' Hall on Thursday, February 2nd, under the management of a committee, consisting of Messrs. Sorby, Baker, and Stuart. An interesting collection of objects, too numerous to particularise, was exhibited. It may, however, be mentioned that Mr. H. C. Sorby, F.R.S., of Sheffield, showed various spectra of fresh and old blood, illustrating a new method of detecting blood stains; stains of various kinds on linen, &c., as illustrations of the spectrum method in detecting minute quantities of blood when other methods would fail; and microscopical photographs of various kinds of iron and steel. Mr. Abel, Royal Arsenal, Woolwich, showed specimens of various fuzes for firing guns or for blasting by means of his ebonite exploder, for field use. Messrs. Day and Son, of Lincoln's-inn, showed a facsimile in photozincography of Shakspeare's first folio. Mr. Ellis, of Sheffield, showed specimens of a new method of photographic printing so as to make the contrast of light and shade not so objectionable, and some incised disks rotating by the influence of magnetism induced by the earth. The evening was enlivened by music.

Westminster Working Men's Club, Duck-lane.—The fourth anniversary of this Institution was held on Thursday evening, the 15th December, and passed off most successfully. The lecture-room was filled with working men. The chair was taken by Sir R. Carden, who was supported by the Rev. Canon Conway, the Rev. J. B. Owen, the Rev. T. Wright, J. G. Gent, Esq., Judge Payne, &c., and the committees of the Club and Temperance Association, and members of the singing class. Mrs. Cooper and Miss Adeline Cooper were also present. Mr. Edward Stephens, the secretary of the club, read the report, from which it appeared that the club was commenced, with one room, in December, 1860, an upper room being acquired and added in December, 1861; and in November, 1863, an adjoining house was taken, and the whole building remodelled to meet the requirements of the members, 1,040 of whom had been enrolled on the books; but as some had left the district, there were about 800 members, with an average weekly attendance of 240. The Institution was managed entirely by the members; the rules had been well observed, and not a book or periodical had been taken away. The educational classes had been of great benefit to the members, and they deeply regretted that Mr. Jewell, on account of increase of business, was compelled to cease his attendance; the Bible Class would shortly be resumed, and the members' thanks were offered to the Rev. Mr. Wright, who had so ably conducted it; thirteen lectures had been delivered on a variety of interesting and scientific subjects, many of them illustrated with diagrams, chemical experiments, &c. In the penny banks the deposits had been £81 4s. 1d., and from the commencement, in January, 1861, £232 1s. 9d., of which £215 1s. 3d. had been withdrawn. The enrolled Labour Loan Society had seventy-nine members, with a capital of £112 14s. 2½d. The loans granted during the year amounted to £228, in sums varying from 10s. to £13, and there had been in circulation, since the commencement of the society in July, 1861, £748 18s. 10d.; there had been no defaulters, only one summons having been taken out but never served. 259 temperance pledges had been taken, and £7 5s. had been paid into the sick fund (one penny per week); £5 11s. 3½d. had been paid in sickness, and there was a balance of £7 9s. 8½d. in

the treasurer's hands. The Barrow Club for costermongers had furnished fifteen members with barrows, who, at the expiration of fifty weeks, had become proprietors of their barrows, instead of going on all their lives paying 1s. 3d. or 1s. 6d. a-week for the hire of one. Allusion was made to the recent death of the club-room keeper, Mr. George Marchant, whom, as a mark of respect, the members had carried and followed to his last resting place in Brompton Cemetery; also to the expected loss of the club, through the improvements (so-called) which were causing the destruction of large numbers of their dwellings, forcing the members to crowd into the few poor houses left them, to the destruction of every moral and religious feeling, as they were excluded from the large model buildings erected on the site of their dwellings, either on account of their occupation or from the rent being beyond their means. The report concluded with the warm thanks of the committee and members to Miss Adeline Cooper, the foundress of the Institution, for her untiring care and zeal on their behalf, and to the many friends who had so kindly assisted them at all times. The Chairman (who was received with great applause) said he was glad he had called on Mr. Stephens to read the report first, as it really contained all that he could say about the excellence of the club. He could not realise the fact that so useful a building would be swept away, but certainly ample compensation ought to be made, so as to obtain an equally comfortable one. As regarded the dwellings of the poor, they had much cause for complaint, and he considered Mr. Peabody's money had not been properly employed, as the rents only suited those who had regular incomes of £1 15s. or £2 a-week; what the poor wanted was more dwellings with two rooms, one for the males and one for the females, at a rent of 2s. or 2s. 6d. a-week; when those were obtained we might be said to have made a step in the right direction. The Rev. Mr. Owen, Mr. Deputy-Judge Payne, and others addressed the meeting.

Fine Arts.

Bust of Mr. Sassoon.—Mr. Thomas Woolner has completed the clay model of a bust of the late Mr. David Sassoon, which is to be executed in marble for the Bombay Museum—an Institution which has largely shared in the munificence of a man who, if not widely known in this country, is famous throughout the extent of China and Japan, as well as India, Persia, and Turkey, for his exercise of charity and benevolence. To him is owing the endowment of a Reformatory and Industrial Institution at Bombay, a Public School for boys and girls, and a Synagogue at Bombay, as well as another at Poonah. The Sassoon Hospital at Poonah is one of the most costly and beneficent of his works. A Mechanics' Institute at Bombay, cemeteries there, as well as at Shanghai, Poonah, and Hong-Kong; a free poor-house at Poonah, together with substantial encouragements, in the form of almost unlimited contributions, to every benevolent and charitable undertaking on behalf of humanity, may be mentioned as some of the achievements of his life.

The Pourtales Gallery.—The coming dispersion of this famous collection is creating a great sensation in Paris. It is one of the most important private galleries in France, and indeed in the world, especially in antiquities small bronzes, enamels, ivory carvings, medals, and miscellaneous articles; the pictures and sketches are not remarkably numerous, but they are very choice, and include some magnificent works. The late Count Pourtalès Gorgier erected an elegant building for the reception of this fine museum in the Rue Tronchet, near the church of the Madeleine, and in this almost every article was to be seen in the most advantageous light. By will, he directed that the collection should not be sold till ten years after his death, hoping, it is said, that the whole would be purchased by the French government and thus be kept together. This has not occurred, and in a few days the auctioneer will have to decide the destination of its remarkable and varied contents. The sale will occupy about thirty days, extending over the three coming months, and there is no doubt that the concourse of amateurs will be almost unprecedented. The gallery has been open to view four or five days; on the first three by ticket, and afterwards to the public at large, and the rooms have been literally crammed by the fashionable, the artistic, and the curious. How the gallery will be made to accommodate the amateurs, agents, and the public who will flock to it is a riddle. An unpleasant circumstance happened on the last day of the private exhibition; a cup and vase of exquisite Florentine bronze were stolen, and in spite of the doors being closed and strict search being made for suspicious characters, no clue was obtained to the culprit, who escaped with his booty.

Flandrin Exhibition.—It is decided that the collective exhibition of the works of the late Hippolyte Flandrin, which is to take place in the gallery of the Ecole des Beaux Arts, in Paris, shall be opened on the 15th of the present month, and closed on the same day in March.

Monument to Marshal Moncey.—The monument which is about to be erected on the spot where the Barrier of Clichy formerly stood, to commemorate the brave defence made there in 1814, and which has already been referred to in the pages of the *Journal*, will be of a different kind to that first projected. It will resemble in some degree the beautiful fountain in the garden behind the great central market of Paris, in part originally designed and executed by the famous sculptor, Jean Gougon, who fell in the massacre of Saint Bartholomew, and also the tomb of Casimir Périer, in the cemetery of Père la Chaise. The statue of the marshal will be placed under an architectural canopy or *édicule*, with open arches on the four sides, and the events which the monument is intended to record will be represented in bas-reliefs on the base. This is certainly a great improvement on the proposed allegorical group of the marshal, surrounded by a soldier, a pensioner, a polytechnic scholar, and an *ouvrier*, supporting the genius of France, and is likely to prove a great ornament to the *Place* it is to decorate. Unfortunately, it is to be disfigured as a work of art by four lions' heads spouting water into as many basins below. The model, one-fifth the size of the intended monument, is now to be seen at the Hôtel de Ville.

Manufactures.

Steam in France.—The Government of France has just issued a decree materially altering the regulations laid down in 1843. These were not in accordance with the growth of machinery and trade, and very irksome to those against whom they operated. In 1850, there were but 6,832 steam engines in all France; in 1863 there were 22,516, representing a force of 617,890 horse-power, or nearly that of two millions of horses in reality, and which is set down as more than the force of all the men in the kingdom capable of labour. Under such circumstances, and the greatly extended practice and increased knowledge of engine-makers, the old regulations had become quite inapplicable. The new decree greatly simplifies the legislation on the subject. The testing of various parts of the machinery officially, till now imperative, has been done away with, except as regards the boiler, which will in future have to be proved up to twice the effective pressure of the steam. Steam engines are no longer to be regarded as dangerous machines, and may henceforth be set up without authority from the officers of government, and without any other form than a declaration of the fact. Boilers are, as heretofore, divided into

three classes, according to their capacity and the pressure to be employed; the regulations concerning the first class are greatly simplified, those of the second class may be set up in any factory or workshop not connected with the dwelling houses of other parties than the proprietor, his family, and workpeople, and the least dangerous class may be introduced even into houses occupied by any number of separate families; and even with regard to other cases, the consent of the neighbours is sufficient to set aside the regulations. Another important provision of the new law is, that all steam boilers shall consume their own smoke, six months grace being, however, allowed for the necessary arrangements to be made. There are other clauses well worth the attention of governments and sanitary boards.

Agriculture in France.—The condition of agriculture in France is undergoing the same changes as the trade and commerce of the country, and offers a wide field of study. A new green crop, called *Brome*, has recently attracted much attention, in consequence of the perseverance of M. A. Lavallée. A farmer at Trappes, M. Dailly, has produced 31 tons of green brome per hectare (or more than 12 tons per acre); M. Benoit, of Azy, obtained 35 kilogs. from 200 grammes of seed, or 185 times in weight of the seed; another farmer got 74 kilogs. from one kilogramme of seed. It is claimed for the brome that it promises to feed three bullocks where two were fed before; a magnificent prospect for the beef eater as well as the beef grower. The plant is well known in China, and the Minister of Agriculture, at the instance of M. Barral, the editor of the *Journal of Practical Agriculture*, has taken means for obtaining a good supply of the seed. One great peculiarity of the brome is its growth during an amount of cold which suspends all other vegetation, thus affording green food for cattle before and after all other sources are cut off, and fitting it peculiarly for exposed situations and arid soils. Some years since a farmer in the department of Finistère, received some leguminous seeds from America, and has ever since cultivated the plant with great success; this turns out now, it is said, to be identical with the brome in question. Two new varieties of trefoil are also being cultivated; one with white flowers, and being a month later than the other kinds; the other bearing yellow blossoms, and growing vigorously in silicious and almost sterile lands. A new lucerne from China, known there as *Mou sou*, and described in M. Paulthier's elaborate work on the plants of the Celestial Empire, is also being experimented on, and is said to promise well. It is sown with millet, as lucerne is sown in Europe with oats and wheat, and will sprout even through snow. The leaves are yellowish, and its flowers, red and black, are so brilliant that the plant was at first used for garden borders. A Russian gentleman, M. Skatschkoff, has introduced the *Mou-sou* into the provinces of Odessa, Kasan, and Moscow, and, in spite of the cold, it has succeeded as well as in China.

Commerce.

Coal-tar Dyes.—The trade, which began in 1860, continues to expand, amounting probably at present to from a quarter to half-a-million annually. The colours are magenta, various shades of blue and violet, purple, yellow, orange, and green. The dyes are sent from London to Lancashire and Yorkshire, and various other places, to be used in the preparation of silk and cotton velvets, printed calicoes, delaines, merinos, finished cottons, silks, ribbons, flannels, and fancy and flannel shirtings. An export trade is beginning to China and the United States, the dyes being sent in their solid form to save freight. In consequence of the extensive use of the new article, the market for cochineal, safflower, and common dye woods has no doubt suffered very considerably.

Coal Trade.—Messrs. W. H. Laird thus write in their Export Coal Circular:—In the year 1860 the Great Float, Birkenhead, was opened, and the Export Coal Trade was removed to that locality from the Morpeth and Egerton Docks, where, previous to that period, coal had been shipped. The arrangements for the trade have been improved; since it was first opened, three staiths, for the shipment of coal on the hydraulic principle, have been erected, and have gradually come into very general use for small-sized vessels, of 500 tons and under, but larger vessels, as a rule, still load by the barrow system. About September, 1863, the Great Low Water Basin was opened, which enabled vessels of the largest tonnage to enter the Float on any tide, either neap or spring; and when the sluicing operation is perfected, it is expected the basin will always be kept free of silt and accumulations of mud. The Great Northern deep water entrances into the Float from the river are expected to be completed in the course of a few months, and will render perfect, we hope, the facilities for ships entering or leaving this magnificent basin of water, and give still further impetus to its export trade in coal. We may give some idea of the progress of Birkenhead, by stating that the business done in coal there by rail in the year 1860 was 236,667 tons, in 1863 it was 427,931 tons, and in 1864 525,665 tons. During the past year Liverpool has made a stride in its coal export trade, not surpassed or equalled by any other port in the kingdom, and Birkenhead has contributed materially to this progress. On comparing statistics, we observe that the exports of 1863 as compared with 1862, from the separate localities, as classified, show:—From north-eastern ports a decrease of 7 per cent.; from Liverpool a decrease of $3\frac{3}{4}$ per cent.; from Scotch a decrease of $3\frac{1}{2}$ per cent.; from Yorkshire an increase of $4\frac{1}{2}$ per cent.; from Severn an increase of $6\frac{3}{4}$ per cent. The total of the exports 7,529,341, in 1863, against 7,694,558, in 1862, showing a decrease in 1863 of $2\frac{1}{8}$ per cent. The year 1864, as compared with 1863, shows a material improvement in the coal trade of the country, more particularly as regards Liverpool and Birkenhead. The total exports from the port of Liverpool in 1864 were 746,842 tons, of which the shipments at Birkenhead have been 313,398, the increase of the port being nearly 30 per cent. as compared with 1863. The comparative statement of exports from each district during 1864 and 1863 is as follows:—From Yorkshire ports a decrease of 1 per cent.; from Northern ports an increase of 3 per cent.; from Liverpool ports an increase of 30 per cent.; from Severn ports an increase of 9 per cent.; from Scotch ports an increase of 11 per cent.; showing on the total exports of the kingdom an increase in 1864 of 544,984 tons, or about $6\frac{3}{4}$ per cent., viz., 8,074,325 tons, against 7,529,341 tons in 1863.

Senegal Cotton.—The *Moniteur de la Flotte* contains an account of a successful plantation of 150 acres of cotton in Senegal. The ground was divided into five unequal parts. One portion, extending over 50 acres, was planted with the native cotton of Senegal. After the ground was cleared, well-handled drills were opened six feet apart, and the sowing was commenced at the beginning of August. In consequence of the abundant rain which fell that month, the young plants attained an unusual size. To the west and north of Taouey is a vast tract of land covered with brushwood, which grew to a great height. The ground was cleared with some difficulty, and sown, as an experiment, with seed of Georgian long-silk cotton, Jumel, Louisiana, and Algerian. The ground was selected because the various kinds of cotton could be planted near each other, and from its position it could be more easily inspected. The soil, moreover, is of various qualities—sandy and damp, suited to Algerian cotton, and in other places rich in vegetable matter. The planter began to clear the land on the 16th of August, he finished on the 6th of September, and the ground was levelled to the extent of 40 acres. On the 17th of September he opened trenches 1 foot wide and 8 inches deep. He sowed the seed of the long-silk Georgian cotton in the bottom of the

trench. In this he followed the Egyptian plan, because the long-silk Georgian cotton requires irrigation. The trenches are calculated to retain the water and the consequent humidity as long as possible. The last sowing succeeded perfectly, and by the last accounts the young plants are flourishing. That was the second experiment the planter tried, and it extended over a surface of 24 acres. The planter expected that by the end of October the entire tract would be levelled and sown.

Beetroot Sugar.—Messrs. W. Connal and Co., of Glasgow, in their monthly circular, state—By the most recent statistics, the estimates of beetroot sugar, for the whole of Europe, for the season 1864-5, show an increase of from 35,000 to 40,000 tons over the ascertained production of 1863-64, which was 388,094 tons, as will be seen from the subjoined table. It is, however, obviously a crop more susceptible of injury from the weather than that produced from the cane in the tropics. The confident estimate formed in France of a crop for this season of 200,000 tons resulting, so far as the manufacture has progressed up to the latest date, in one not likely to exceed 128,000 tons, illustrates how critical it must prove as a source of supply. The manufacture, however, is followed out with great spirit; and whereas last year there were 364 manufactories at work, there is this year an increase of 33, notwithstanding that, as a branch of industry in France, it is considered to have been unremunerative last year to the cultivator as well as to the manufacturer:—

	1864-65. Estimates.	1863-64. Productions.
Zollverein	165,000	155,180
France	120,000	108,467
Austria	65,000	60,916
Russia	40,000	35,000
Belgium	22,500	20,031
Poland and Sweden	10,000	10,000
Holland	2,500	2,500
Spain	500	—
Total tons	425,500	388,094

With the view of securing a uniform system for duties and drawbacks, a treaty is now under the consideration of the Governments of England, France, Holland, and Belgium, but it is premature to offer an opinion until the scale is adjusted, as to its bearing on the interests of the British refiners.

The Porcelain Trade in Paris.—The gilding and painting of porcelain gives occupation, in Paris alone, to 1,872 hands, including 458 workwomen; the trade is carried on by 187 master-decorators, and produces to the amount of about 5,300,000f. a year, more than 850,000f. worth of which is exported. There are forty-three workmen who earn 8f. a day; five who earn 9f., and four who earn 12f.; but these are the aristocracy of the trade, the generality earning only 5f. a day, when they are employed by a master. As for those who have the presumption o setting up for themselves and working on their own account, there are thirty-three who make less than 2,000f. profit a year, that is, who are actually starving; for their lodging, which must be fit to carry on the trade in, does not cost them less than 1,000f. a year; with the rest they and their family must live and find their clothing. Women generally earn from 2f. to 2f. 50c. a day; the most skilful earn 4f. 50c. at the utmost. The master decorator takes as many apprentices as he can, and it is they, who either get no wages at all or else not more than 25c. or 1f. a day, who do the largest share of the work. Females generally work at home, but their earnings rarely exceed 25f. or 30f. a fortnight.

Colonies.

New Zealand Exhibition.—The province of Canterbury is now rapidly preparing for the Exhibition. It has the merit of possessing the first locomotive railway, and the illustrating of the works connected with that great engineering enterprise will form one of the most striking features in the Exhibition. It is proposed to exhibit, for instance, an immense section of the tunnel that is in the course of construction, with specimens of the rocks for every few feet that has been passed through. The geological strata and mineral resources of the province are to be fully illustrated by most elaborate maps, sections, and collections, both of scientific and economic interest. Maps and plans, showing the system of survey and land sales, proposed railway, road, and telegraphic routes, topographical features of the country, harbour improvements, architectural designs for public buildings are to be furnished, also specimens of lithography and engraving. The display of wools will show the important position occupied by the province in this respect, and enable the flock-owners to compare the produce from different parts of their own province with those of the rest of New Zealand. Works of art, articles of home manufacture, such as cabinet work, saddlery, &c., may also be looked for.

Clarence River Cotton, New South Wales.—During the past season a proprietor planted four acres, two acres with New Orleans seed, and two with the Sea Island cotton, by way of experiment. The Sea Island was almost a failure, but from off the two acres of New Orleans 32cwt. of cotton in the seed was picked, which would yield about 1,000lbs. of clean cotton, and at the price obtained for the Clarence River cotton formerly sent home, namely, 2s. 2d. per lb., would give a return at the rate of £57 13s. per acre. Six cwt. of the New Orleans cotton has been forwarded to Sydney to be ginned. The above yield, considering the very wet weather, shows that in ordinary seasons the crop would, in all probability, be much greater.

The Melbourne and Suburban Railway has been purchased, conditionally on legislative sanction, by the Hobson Bay Railway. The consideration for which the property is to be handed over is £267,000. In the construction of the line about £600,000 was expended, so that it is now sold for less than half its cost.

Victorian Railways.—The traffic returns for the month of October show a total of receipts amounting to £44,710 6s. 7d. against £37,843 4s. 9d., exhibiting an increase for the month of £6,866 1s. 10d.

Obituary.

Death of the Painter Court.—France has lost an able artist by the death of Joseph Désiré Court. He was a pupil of Gros, and took the prize of Rome in 1821. His best known works are "The Death of Cæsar," now in the Luxembourg, and the large picture of "Boissy d'Anglas," which forms part of the public collection of the town of Rouen, of which M. Court was curator. Some years since he was among the most fashionable, as well as ablest, portrait painters in Paris.

Publications Issued.

L'Ecole. By Jules Simon. Lacroix and Co., Paris. 8vo.—An important volume by the author of some of the most remarkable works on social economy and cognate subjects that have appeared in France. M. Jules Simon was assistant minister of public instruction during the short reign of the republic of 1848, and earned a name in history by his indefatigable endeavours to raise the educational standard of the mass of his countrymen. He now represents one of the electoral divisions of Paris in the Chamber, and allows no opportunity of pursuing his former labours to escape him. M. Simon is the strenuous advocate of gratuitous and compulsory public education

as embodied in a bill by his friend and chief, M. Carnot, and presented to the legislature in June, 1848. According to the provisions of this proposed law it was imperative upon every parent to give his child, whether male or female, at least primary instruction, and the public schools were to be open to all without charge. To carry out these views, MM. Carnot and Jules Simon were compelled to set down the sum of forty-seven millions of francs in the budget, and in the then state of the finances such figures would have been fatal to the projected measure, which, however, was withdrawn by M. Carnot's successor, M. Falloux, before the committee had presented its report. One clause of this bill alone reflects the greatest credit upon its originators; for the first time in France it placed girls and boys, and male and female teachers, on a level, recognizing an equality of rights as regards instruction and compensation in one as in the other case. In 1850 the Assembly voted a new law, proposed by M. Falloux, which created eighty-six academies, and distributed patronage between the government, the rectors of colleges, and the ecclesiastics. By this law the minimum salary of a common school-master was fixed at 600 francs (£24) per annum, while the payment of school-mistresses was left entirely in the hands of the local authorities. The organic decree of the Emperor Napoleon, in 1852, made little change in the law; but in 1854 another decree took the appointment of common school teachers out of the hands of the rectors of the academies, and placed it entirely in the hands of the Prefects, acting under the authority of the Minister of Public Instruction. Other decrees have since ameliorated the condition of the teachers of these schools, and recognised the claims of school-mistresses to remuneration. M. Jules Simon admits fairly that a good deal has been done during the last ten years towards improving the condition of the schools for the children of the poor, but he declares the system to be still unworthy of the age in which we live. It would be impossible here to follow the entire course of M. Jules Simon's argument; suffice it to say that he complains loudly, not only as to the quantity, but to the quality of instruction afforded, and he relies principally on the following facts and figures, drawn from official documents or other governmental sources, for the justification of his complaints. The minimum amount of remuneration for school-masters is still only 600 francs. After five years' service this is raised to 700 francs, but the Minister of Public Instruction may, if he think fit, raise the payment of one-twentieth of the masters to 800 francs; after ten years' service to 900 francs; after fifteen years, "by way of favour or recompense." The masters' pay ranges, therefore, from £24 to £28 a-year, with a chance of a bonus of £4 or £8 per annum. A superannuation fund has also been instituted, but its means are yet so small that, in 1863, the pensions only amounted to 68 francs (£2 14s. 6d.) per annum. There are in France 19,423 masters whose salary is below 700 francs, and 2,120 supplementary teachers whose pay is below 600 francs. "After five years' service," says M. Jules Simon, "a school-master is in receipt of 1fr. 80c. per day, less than the pay of a gendarme or lowest custom-house official," who, in addition, have food, clothing, and lodging supplied to them. As regards school-mistresses, they now figure in the budget for the sum of 360,000 francs (£14,400), which is employed by the Minister "by way of encouragement and assistance." The sad condition of lay female teachers seems to arise from the competition between them and the members of religious communities, who enjoy a most extraordinary privilege. All other teachers, public or private, are compelled to undergo an examination, and no one can exercise the calling of a teacher without being the possessor of a certificate of capacity. By a clause of the law of 1850, however, any nun or member of a religious congregation devoted to instruction, and recognised by the authorities, may act as a school-mistress without any examination whatever, "letters of obedience," that is to say, a note from the hand of the superior of the establishment being all-sufficient. The sisters are paid only about 300 francs a-year, and the consequence is that a very considerable number of lay teachers—as many as 4,756—are reduced to find themselves in food and clothing, if not in lodging also, for less than £16 a-year. But there is another phase of this question which M. Jules Simon regards as even more serious; the acquirements demanded of female teachers are of the simplest kind—reading, grammar (limited in practice almost entirely to orthography), writing, and the four simple rules of arithmetic—division (says M. Simon) not being very rigidly enforced. Some of the sisters, although not compelled to do so, submit to an examination, and of their whole number 766 hold diplomas, while 12,335 have only letters of obedience, and M. Jules Simon sees no escape from the conclusion that these 12,000 clerical teachers of youth feel themselves incapable of exhibiting their knowledge of the simple elements of education. If such be the case, seeing that about two-thirds of the girls in the communal schools are taught by sisters, it is not difficult to account for the fact that in the last official return nearly 10,000 girls' schools are reported as passable, mediocre, or bad. M. Simon, too, like many other men, protests against the practice of girls who are to become wives and mothers being trained by mistresses who have renounced the world, and have, therefore, no experience in its duties. There are in France more than 52,000 schools, of which nearly 14,000 are for girls only, and rather more than 18,000 receive children of both sexes. Yet there are some 600,000 children who are not supposed to receive any education whatever, while the instruction of the greater part of the remainder is considered by M. Simon to be of the most unsatisfactory kind. "One-half," he says, "of the 4,296,641 inscribed on the school lists are merely nominally at school; they pass three or four weeks on the forms, to quit them in the first days of spring, and return next year as ignorant as ever. The greater number, even amongst the most assiduous, obtain no instruction deserving the name, never learn to read well enough for it to be a pleasure to them, and, at the end of three years or so, become as completely illiterate as if they had never held an alphabet in their hands." To a certain extent, this opinion is supported by the official returns, by which it appears, that in 1860, 37½ out of every 100 men married could not sign their name, and that more than 27 out of a hundred young men, in their twentieth year, liable to the conscription, were unable even to read. M. Jules Simon concludes that "if one-quarter of the population cannot read at twenty, while only about one-eighth of the children do not go to any school whatever, it is evident that in order to read it is not sufficient to go to school." The governmental vote towards the support of the common schools is, for 1865, 6,843,000 francs; the departments contribute 6,582,000; and the communes themselves about eleven millions; and the total cost of the communal schools is rather more than thirty millions a year; the difference is made up by the payments of the parents of something less than a third of the total number of the scholars. M. Jules Simon complains that the amount spent on the people's education is out of all proportion to the other state expenditure, and General A. Morin, at the annual meeting of the five academies of the *Institut*, in August last, produced a comparative statement of the relative amounts spent by various states for war and education respectively, which showed that France stood very low in the scale, ranking below Austria, Prussia, Bavaria, Wurtemberg, Saxony, Baden, and Hanover. M. Jules Simon's book contains a large amount of information, and should not be neglected by any friend of national education.

Notes.

Exhibition of Sculpture in 1865 at the Royal Horticultural Society.—The exhibitions of sculpture

in the Gardens have shown how many beautiful effects may be produced by the combination of sculpture and foliage, and have shadowed forth a new development of the art of sculpture in this country, where it is the instinct of the people to cultivate flowers and gardens. The Council therefore continue the sculpture exhibition for the third year, and announce the arrangements for the year 1865. 1. Out of the exhibition of 1865 the Council will make purchases to the value of five hundred pounds, provided that new and original works of sufficient merit are exhibited under the conditions hereafter stated. 2. As a general rule it is desirable that all works should be finished works in plaster. But works in marble, bronze, terra-cotta, and other materials than plaster may be sent; the price of a separate plaster copy must be stated. 3. The Society especially desires that all works sent in should be distinctly labelled with the name of the subject, and the artist's name and address, together with *the price at which copies may be sold to the public*, in marble, bronze, terra-cotta, and plaster. 4. When a plaster model is purchased by the Council they desire to be informed at what price the artist will supply another copy in marble, or bronze, or terra-cotta, or any other material. The copyright of making and disposing of other copies in marble, bronze, terra-cotta, etc., will remain with the artist. 5. It is especially desirable that the works sent for purchase in 1865 should be life sized models of animals, single figures, or groups of figures, large ornamental vases with bas-reliefs, or ornamental pedestals with bas-reliefs, but not simply bas-reliefs unapplied. 6. The works must be delivered at the Gardens and removed from them at the conclusion of the exhibition free of charge. As respects works proposed to be sent from abroad it is desirable that photographs should be sent before 1st March, 1865. If the work be approved, the Council will pay the carriage to the Gardens. 7. The Council will take the utmost care of the works, but will not be responsible for any accidents arising from any cause. 8. Artists of all nations are invited to send works. 9. All works for 1865 must be sent on or before 15th April, 1865, and must be left in the Gardens until the 30th September.

AN INTERNATIONAL FRUIT SHOW is appointed by the Royal Horticultural Society to take place from Saturday, 9th December, to Saturday, 16th December, 1865, inclusive. The gold medals of the Society will be awarded for the best collection of fruit and vegetables produced in the garden of a Sovereign; also for the best collection of fruit and vegetables grown by any Botanic or Horticultural Society in any part of the world; also, the best and most complete representative collection of fruit and vegetables from any of the colonies; also for the best and most complete representative collection from the Presidencies of India. Certificates will be awarded for separate exhibitions of fruits and vegetables, either fresh or preserved, from all parts of the world. The first, second, and third gold Knightian medals of the Society to the second and third exhibitor who shall obtain the greatest number of first, second, and third-class certificates respectively. The first gold Banksian medal will be given to the exhibitor who shall gain the greatest number of marks, counting first, second, and third certificates as three, two, and one marks respectively.

SCHOLASTIC EXAMINATION.—In France, where so many young men are employed in the public service, the *Baccalauréat*, or degree of Bachelor of Letters or Sciences, is indispensable for any official career, and superior degrees are in many cases insisted on; moreover, at the present moment, the Ministry of Public Instruction is presided over by a gentleman who, but the other day, was a Professor in one of the colleges. Under these circumstances it is not surprising that the systems of instruction and examination in the public schools should, at the present moment, be the objects of serious study and important ameliorations. The Minister in question, M. Duruy, has just issued a remarkable circular upon the subject of examination for the *Baccalauréat*, of which the following is a *resumé*:—"In no well-conducted school is a pupil permitted to pass from one class to another until he has acquired in the first the necessary knowledge to enable him to follow the second with profit. The *Baccalauréat* is but the last and most important of these examinations. The object is to show that the pupil has obtained from the school what he went there for, on the eve of his entering into public or private life, or of his entering upon a course of higher or special instruction. Is it a mass of ephemeral information that is required?—No! This is the means, not the end of education.—The real object is to cultivate—to exercise—the pupil's mind by an acquaintance with the masters of human thought. Special knowledge is to be obtained in the professional schools. * * * In the *Lycée* we prepare the man. In this distinction consists the whole rule of our national educational system. But if classical instruction—which, with so much reason, is called liberal education—proposes to develope harmoniously all the faculties of man, without regard to any determined direction, it follows that the examination which tests the results of such education ought to be conducted in such a manner as to convince the pupil that the proof is sought in his intelligence and not his memory, and that less importance will be attached to that accumulation of knowledge which will scarcely resist a few months' idleness, than to evidence, furnished by himself, that he has become familiar with the main facts of history—with the great works of the human mind—with good scientific methods—and, above all, that he is capable of speaking and writing with propriety. Is it necessary, for this end, to compel the pupil to repeat at the last moment, by a desperate effort of memory, the whole course of his studies? It is not the matter of the instruction, but the qualities of the mind developed by study; this is what the examination should bring out. * * *Le Legislator* of 1808 was of this opinion, the candidate for the degree was only required to answer on the subject matter of the two highest classes—those of rhetoric and philosophy." The Minister then proposes to return to this state of things:—"To suppress the whole apparatus of programmes; to strengthen the examination by simplifying it. The *Baccalauréat*," he adds, "has a double character; it is not a competition in which the most worthy carries off the only crown; it is simply the evidence of honest study, and the diploma should be given to all whose replies render them worthy to be classed amongst men of liberal education; but it is also a barrier which defends the higher colleges and administrations, public and private, against the incapables; it is the first elementary proof, at the threshold of civil life, and the first practical lesson of morality received by young men. At this time, when attention is being everywhere given to the placing of special education for the arts and industries on solid bases, it would be most unwise to lower the level of general instruction. The people are rising, and more intelligence is now-a-days expended in trade than heretofore was required at the bar. That those who aspire to serve the state, to honour the nation in literature or science, or to conquer public confidence in the liberal professions, may maintain their position in advance, the preliminary studies, on which the rest of life depends, must be rendered more serious, and the University, on its side, must occupy itself with rendering them at once less difficult and more effective." M. Duruy in like manner claims, for the candidate in sciences, that the examination should refer simply to elementary mathematics. In accordance with these views of the Minister, a decree has been issued, by which the examinations of candidates for the *Baccalauréat* are restricted to the subjects mentioned above—"rhetoric and philosophy" for the candidates in letters, and "elementary mathematics" for the candidates for a scientific degree.

MUSEUM OF CARRIAGES.—A curious building is being erected, adjoining the Museum of Cluny and the ruins of the Roman palace of Thermes, in Paris; it is a covered arcade, the arches of which will hereafter be filled in with

glass; the walls are composed, like those of the old palace, of alternate courses of brick and stone, and the roof is covered with tiles cut in geometric forms. The intended application of this structure is the formation of a collection of Italian carriages of the sixteenth century, and probably others. There are three curious vehicles now in the adjoining museum which will form part of the new department.

GEOLOGISTS' ASSOCIATION.—On Tuesday evening, at the ordinary meeting, Mr. S. Carter Blake, F.G.S., read a paper on the "Geological Evidences of the present Domesticated Animals;" and Mr. Wm. Hislop, F.R.A.S., read his third note on "Microscopic Geology." The meeting was well attended, and some interesting remarks were elicited by the discussion which followed the reading of the papers.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Society of Arts, 8. Cantor Lectures. Professor Ansted' F.R.S., "On the Applications of Geology to the Arts and Manufactures."
R. Geographical, 8½. 1. Mr. R. Temple, "On the Basin of the River Mahanuddy." 2, Dr. Bastian, "Visit to the Ruined Cities of Cambodia."
TUES. ...Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."
Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. John England, "Giffard's Injector."
Zoological, 8½.
Syro-Egyptian, 7½. Rev. John Mills, "On the Church of the Holy Sepulchre."
Anthropological, 8.
WED. ...Society of Arts, 8. Mr. Thomas Webster, Q.C., F.R.S., "On the Claims of Authors and Inventors to Property in and Protection for Designs and Inventions first published at Industrial Exhibitions."
Meteorological, 7.
London Inst., 7.
R. Society of Literature, 4½.
THURS...Zoological, 4.
Royal, 8½.
Antiquaries, 8.
Linnæan, 8.
Chemical, 8. 1. Mr. J. Broughton, "New Reaction for preparing Anhydrides and Ethers." 2. Dr. Fraser, "Chemistry of Calabar Bean.' 3. Dr. Crace Calvert, "Action of Silicate and Carbonate of Soda on Cotton Fibre." 4. Mr. S. Highley, "New Electric Lamp Regulator, &c." 5. Mr. J. Spiller, "Oxidation of India-rubber."
Numismatic, 7.
R. Society Club, 6.
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."
FRI.......Geological, 1. Annual Meeting.
Philological, 8.
Royal Inst., 8. Mr. W. Huggins, "On the Physical and Chemical Constitution of the Fixed Stars and Nebulæ."
SAT.......Royal Inst., 3. Prof. Marshall, F.R.S., "On the Nervous System."

Patents.

From Commissioners of Patents Journal, February 3rd.

GRANTS OF PROVISIONAL PROTECTION.

Books, &c., preserving from fire—71—F. Wiese.
Boots, &c., manufacture of—169—W. Clark.
Bottles, closing the mouths of—132—H. J. Rogers and J. M. Schofield.
Burners and glasses, petroleum and coal oil—201—M. A. Dietz.
Clasps, &c.—185—A. I. L. Gordon.
Combs, elastic dents of expanding and contracting—189—M. Robinson.
Cooking—150—S. Ballard.
Cotton, machinery for ginning—44—B. Dobson, W. Slater and R. Halliwell.
Crinoline skirts, manufacture of—108—J. Knight.
Curtains, suspension of—193—J. Badcock.
Driving rolls for rolling metals—135—R. A. Brooman.
Elastic mattresses and bedding—99—E. T. Hughes.
Engines, packings of pistons and piston rods of—155—W. R. Foster.
Fibrous materials, ginning and cleaning—191—C. B. W. Hoehl and W. Gunther.
Fibrous substances, machinery for preparing, &c.—130—J. B. Farrar and J. Hirst.
Fire-arms, breech-loading—106—G. H. Daw.
Fire-arms, breech-loading—138—G. T. Bousfield.
Fire-arms, breech-loading—139—J. S. Edge, sen.
Fire arms, breech-loading—152—W. E. Newton.
Floor cloths, manufacture of—197—J. B. Wood.
Flower box, ornamental—126—G. Colven.
Fluids, presses for the expression of—134—J. Marshall.
Fluids, regulating the supply of—2659—N. N. L. Lonsdale.
Fog and storm signals, &c.—125—T. Bourne.
Folding chairs, &c.—199—T. Brown.
Furnaces—103—M. Henry.
Furnaces—110—W. S. Longdridge and J. Mash.
Gas retorts, apparatus for charging and drawing—142—S. J. Best and J. J. Holden.
Grain, cleaning and decorticating—115—W. Ager.
Grain, mills for grinding and pulverizing—211—A. Stevenson.
Hammers and pile drivers—181—W. E. Newton.
Iron and steel, furnaces used in the manufacture of—173—J. Hewes.
Keys and locks, construction of—92—J. F. Heather.
Liquid manure, apparatus for distributing—100—W. Russ.
Liquids, ascertaining and indicating the strength of—122—R. A. Brooman.
Looms, &c.—153—J. Burch.
Metals, furnaces for smelting—209—W., R., J., & A. Woodward, jun.
Metals, shaping and forging—165—J. A. Shipton and R. Mitchell.
Mules for spinning and doubling—133—W. Rowbottom.
Music, teaching and transposing—102—R. A. Brooman.
Ordnance and gun barrels—213—J. Marshall and H. Mills.
Ordnance, breech-loading—2994—F. A. Wilson.
Phosphates of lime, &c., for agricultural uses—140—R. A. Brooman.
Pianofortes—141—F. H. Lakin.
Projectiles—171—G. A. Clark.
Railway carriages, signal between passengers and guards—107—J. B. Hill.
Railways, communication between passengers and guards—97—I. Goodlad.
Railways, waggons for the conveyance of cattle upon—3174—W. Reid.
Railways, working switches and signals of—147—W. Jeffreys.
Railway trains, communication between passengers and guards of—121—R. Lea.
Railway trains, communication between passengers, guard, &c.—179—W. Mather.
Railway trains, taking up and delivering mails, &c., while in motion—177—W. Clark.
Railway trains, transmitting letter bags and parcels to and from while in motion—187—C. D. Abel.
Roads, construction and paving of—116—T. G. Pagano.
Sails, reefing and furling—148—A. B. Bull.
Sewing machines—13—G. Mascart.
Sewing machines—144—C. T. Judkins.
Sewing machine shuttles—163—J. F. Bradbury.
Ship building—137—J. Betteley.
Ship compasses—128—J. Lilley.
Ships, giving buoyancy to, and the propulsion of—2405—J. Vine.
Shirt fronts, securing studs in—175—C. Searle.
Sleeve links—120—W. H. Richards.
Soda and potash, manufacture of—2876—A. G. Hunter.
Steam boilers—113—R. Lewis.
Steam boilers, preventing incrustation in—119—G. Davies.
Steam engines—111—W. Brookes.
Steam engines—167—T. C. Durham.
Steam engines—183—T. Lester.
Stones, smoothing the surface of—154—J. Coulter and H. Harpin.
Telegraph conductors and cables, coverings for—98—J. Fuller.
Theatres, working all stage scenery in—131—W. Edwin.
Tills—104—G. Gaze.
Tobacco, machinery for pressing and cutting—123—A. V. Newton.
Transmitting and converting reciprocating motion into rotary motion—145—W. J. Cunningham.
Tubes, cast steel and other metallic—3251—W. H. Brown.
Umbrellas, &c.—114—J. Weekes.
Vehicles, registering the distance travelled by—91—C. M. Bathias.
Warp machinery, manufacture of looped fabrics in—117—W. Wilkins.
Watches, construction of—157—C. D. Abel.
Window-blind cord check—195—E. Templemore.

PATENTS SEALED.

1955. W. R. Taylor.	2108. J. Strouse.
1960. C. W. Lancaster.	2665. R. A. Brooman.
1969. W. E. Gedge.	2756. R. A. Brooman.

From Commissioners of Patents Journal, February 7th.

PATENTS SEALED.

1757. T. Boyle.	2020. G. Bedson.
1975. E. and F. Crook.	3024. W. H. Cox.
1976. D. Spiers, A. Boyd, J. Aitken, and M. Gilmour.	2036. W. Hule.
1978. M. Payne.	2043. P. A. L. de Fontainemoreau.
1988. H. Armistead.	2142. G. Furness and L. G. Moore.
1995. J. Russell.	2303. C. H. Robinson, J. Fryer, and A. Dyson.
1996. R. D. Edwards.	2515. J. Slater.
1997. J. Lang.	2582. W. M. Ryer.
2080. J. Millbank.	2667. W. Jackson.
2007. A. Alison and J. Shaw.	2854. J. Rowley.
2009. H. Dyer.	3042. G. T. Bousfield.
2012. M. Brown.	
2019. W. Richardson.	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

279. W. Clark.	330. W. H. Bartholomew.
283. D. Joy.	374. T. Horsley.
769. R. A. Brooman.	405. W. Avery.
284. C. W. Lancaster.	463. W. Hamer.
290. G. Manwaring.	318. E. T. Bellhouse and W. J. Dording.
320. J. Tonkin.	

THE

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AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, FEBRUARY 17, 1865. [No. 639. Vol. XIII.

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Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

Feb. 22.—"On the Municipal Organisation of Paris, especially with reference to Public Works." By George R. Burnell, Esq., F.G.S.

March 1.—"On the Means employed in taking Fish, especially with reference to Submarine Illumination." By F. W. Campin, Esq.

Cantor Lectures.

The Second Course of Cantor Lectures, the subject being "The Applications of Geology to the Arts and Manufactures," by Professor D. T. Ansted, M.A., F.R.S., is now being delivered on Monday evenings, at Eight o'clock, as follows:—

Feb. 20th.—Lecture 3.—On Mineral Materials used for the Purposes of Construction: Plastic and Incoherent Materials (Clays and Sands).

Feb. 27th.—Lecture 4.—On Mineral Materials (*continued*): Building Stones and Slates, and their Relative Value under given Circumstances of Exposure, and on Methods of Quarrying.

March 6th.—Lecture 5.—On Stratified Deposits of Minerals, as Coal and Iron Ore, usually obtained by Mining Operations, and on Mining Methods for such Deposits.

March 13th.—Lecture 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture.

Final Examinations—Botany.

In addition to the Prizes in this subject offered by the Society of Arts to candidates taking a Certificate of the First Class, the Royal Horticultural Society offers five prizes, of £5, £4, £3, £2, and £1 respectively, to the five candidates, being gardeners by profession, who, taking any grade of certificate in Botany, obtain the highest number of marks in that subject at the Final Examinations in April, 1865.

Musical Education.

The Council have appointed a Committee to inquire into the present state of Musical Education at home and abroad.

A letter has been addressed to the Foreign Office, requesting the aid of Earl Russell in obtaining for the use of the Committee, through the intervention of Her Majesty's Ministers abroad, detailed information concerning the Musical Schools in the principal capitals of Europe, and to this letter the following reply has been received:—

Foreign Office, Feb. 6th, 1865.

Sir,—I have laid before Earl Russell your letter of the 27th ultimo, respecting the desire of the Council of the Society of Arts to obtain, through the intervention of Her Majesty's Representatives at certain places abroad, information with reference to Musical Schools at the places indicated, and I am to request that you will inform the Council that instructions have been sent accordingly.

I am, Sir,
Your most obedient humble servant,
J. Hammond.

The Committee issued the following queries to the professors, amateurs, and others interested in the subject, and desire to obtain their opinions thereon. Members willing to aid them in this inquiry are requested to communicate their views:—

1. What are the essential differences between the plan of the Royal Academy of Music in London, and the Conservatoires of the Continent, with regard to—

a. Their constitution and management;

b. Their revenues as derived from the State, annual subscriptions, fees from pupils, concerts, or other sources.

2. State the nature of any other Institution in the metropolis or the provinces, for providing or improving Musical Education.

3. The expediency or otherwise of taking the present Royal Academy of Music as the basis of any enlarged Institution in this country.

4. What improvements might be effected in the Royal Academy of Music?

5. Is any union between the Royal A ademy and similar Schools, Cathedral Choirs, or Local Institutions desirable or otherwise?

6. Could the Local Examinations of the Royal Academy of Music be extended, and how?

7. Does the Royal Academy in any way promote the improvement of Military Music?

8. Could any useful connection be established by the Academy with the Regimental Volunteers or other trained Musical Bands?

9. What proper security may be taken for obtaining due results from any Funds granted by Parliament to the Royal Academy?

10. What is your opinion respecting—
   a. The advantages derivable from Public Concerts.
   b. The test of Musical Proficiency by Examinations.
   c. The Formation of a National Musical Library, and of a Collection of Musical Instruments, by gifts, loans, &c.
   d. The Competitive trials of Performers and of Musical Instruments.
   e. The use of a standing Musical Jury, as in the French Institute.

Proceedings of the Society.

Cantor Lectures.

Second Course.—Second Lecture.—Monday, Feb. 13. Springs and Water Supply.

Professor Ansted remarked that a supply of fresh water is a matter of such extreme importance that every inquiry connected with it is well worthy of attention. It is connected with geology, for the conditions under which water exists in the earth depend on the arrangement of rocks and the facilities for circulation among and between them. He proposed to point out the great facts on which water-circulation and water-supply depend, and enable his audience to understand and appreciate the efforts made to obtain ample supplies when required. The source of water is the ocean; the means by which it is transferred from the ocean to the land is the atmosphere; and the circulation of water through the earth is the fact to be borne in mind in all investigations concerning water. Of the rain that falls a large proportion is attracted to the summits and flanks of mountain-chains, to upland valleys and lofty plains; the spots of heaviest rain-fall have the sea at no great distance, and winds blowing more frequently from the sea than from the interior of the country. Much rain reaches the earth on slopes looking towards the sea, and a large quantity of water is conducted by natural channels to rivers, and across low lands to the ocean. But of a large district only a small proportion consists of river-courses, whilst the rain falls on the whole surface. The soil becomes wet, the subsoil behaves in like manner, and moisture reaches the underlying rock. Of the rocks some are sands, sandstones, or limestones, and others fragmentary rocks. These allow water to enter, and give back the water at need. Others are impermeable strata, between or amongst which are beds shutting off water. Such are clays. All rocks contain water. Granites and compact marbles, in their driest state, hold from ·4 to 4 per cent. by weight; and, as a cubic yard of such stone weighs two tons, each ton of the least absorbent rock will contain a pint of water. The water held by common loose sea-sand amounts to at least two gallons in a cubic foot. In ordinary sandstones nearly half that quantity can be contained; and in best sandstones five pints of water are contained in each cubic foot. Thus in an area of such sandstone, occupying ten square miles, and ten yards in thickness, the quantity of water contained is from four to five hundred millions of gallons. This would fill a reservoir of a hundred acres to the depth of ten feet. But sandstones are rarely without bands of clay separating their water contents into sheets, and owing to faults and vertical bands of compact mineral, a sandstone district is broken up into boxes, each one of which is independent to some extent of the rest. Sandstones have also been tilted, and stand at a considerable pitch, tolerably uniform over great distances. Some varieties of sand-rock passing into pudding-stone on the one hand and quartzite on the other contain no water, but even in such rocks there are fissures and cracks wherever there is an exposed surface. Into these water penetrates. Of limestones the least absorbent hold four pints in the cubic foot; while a cubic foot of Bath stone will absorb a gallon; and some magnesian limestones twelve pints. A cubic foot of soft chalk will hold two gallons of water, or as much as loose sand, taking up half its own bulk of water and yet hardly appearing wet. By pumping, a large quantity of water may be obtained from chalk, for it acts as a sponge, the water sinking to the bottom. In most limestones the water does not come away by pumping, being kept back by friction as well as by capillary attraction. Limestone is more available as a water-bearing rock than sandstone, being more cracked and fissured at all depths. It is acted on by water, both mechanically by wear, and chemically by becoming dissolved. The cavernous nature of limestone is one of its most remarkable features, and at the intervals of strata there are spaces allowing a free passage to water, besides vertical fissures, dividing up the mass into smaller areas, each one of which has its own water system, though all communicate. Clays often contain as much as ten per cent. of water (by weight), and clay rocks, such as the varieties of schist, which are extremely numerous, are similarly constituted. Water is present in great abundance in the rocks near the surface of the ear'h, not only in the substance of all, but in the interstices. Of the rain that falls upon the earth at any place not more than one-third runs off the surface and enters the sea by rivers. What becomes of the rest? Part is evaporated; part supplies life; but an ample supply enters the earth. Down natural channels the water passes; occasionally through a permeable rock, sometimes slowly with much interference, and sometimes into cavities. It is conveyed horizontally, and rises here and there to the surface under the influence of the pressure of a column whose height has reference to the level of the spot at which it first entered as rain. This circulation is due to the natural inequalities of the land. As the rain falls mostly on mountains and high ground, and rocks are usually tilted towards the plains, the tendency of water to run down a slope in the interior of the earth as well as on its surface, ensures the conveyance of ample supplies. These may exist under pressure arising from the fact that the channels formed between two impermeable rocks are closed pipes. But because the dip is not always the same as the natural slope of the surface, and that faults remove rocks to a considerable distance vertically, water will sometimes find an issue at a considerable distance; it may well up at a fault, or come out at an artificial cutting, though always at a lower level than that at which it entered. Water obtained by any of these means is called a spring. Land springs occur in sand or gravel, resting on impermeable strata, and receiving a larger quantity of rain on their surface than is carried off by evaporation or streams. The water accumulates below, instead of upon the surface. Its depth is rarely great, and it is reached by wells. The supply varies with the rain-fall, and in dry seasons fails or gets much lower than usual. The quality of such water is

liable to injury, owing to the filtration into it of organic matter from above. Wells in such localities sometimes yield upwards of a hundred grains of solid matter to the gallon. A second class of natural springs issue on hill sides, in valleys, or on plains surrounded by higher land. They depend on the outcrop of strata which carry water, but rest on other strata that are impermeable. The issuing of springs under these circumstances is easily-understood; though the phenomena may become complicated and obscure. The source of the supply may be distant, and much above the level of the point of emergence. When it issues, the water may be a considerable stream, or may drain out in a multitude of springs on a continuous line of outcrop. Groups of springs of this kind are often important, dividing the irregularities of season over a considerable time, and to some extent independent of season. The water, having filtered through the earth for a long distance, is fresh and wholesome. Springs of this kind may be tapped on their way to the natural outlet. The supply they bring is limited, and what is taken at any one place is taken from the general stock. It may be that the upper rock is porous and rests on an underlying, impermeable stratum. The supply is then more abundant but less regular. Good examples of such springs exist in the Cotswolds, where, all along the oolites with the lias, groups of springs issue. A a few days after the rain most of these springs become swollen, and run freely. After dry summer weather the supply falls off. In this case the dip of the beds changes, but the main cause of the irregularity must be sought for in the fact that, though crop-springs in one sense, they are land-springs in the nature of their supply. A third class of mineral springs issues where the containing rocks are interrupted by faults. In this case there are several possibilities. A fault acting as a wall, because it is filled with clay, will in most cases be accompanied by a spring, though not always at the exact spot where we might be inclined to look for it. Artesian springs occur in many places, and have been obtained artificially from the earliest times. A permeable bed between two impermeable beds, crops out at the surface, and there receives the rain-fall and surface-water. The level of this outcrop is higher than that of a part of the surrounding country beneath which the strata pass, owing to their dip. The permeable bed thus represents a bent tube, and may be kept full of water under a pressure corresponding to the height at which the porous bed crops out. If, then, a well is sunk or a hole bored, the water will rise in it, not only towards, but even in some cases far above, the surface, in a jet. The chief Artesian wells, and the oldest in Europe, are in the north of France, and they seem to have spread thence through the other countries of Europe. They are sunk through the lower tertiary strata to the chalk, from whose upper beds the water is generally derived. The construction of this class of wells is easy and inexpensive. The Artesian wells of Artois date back to the twelfth century. In Italy and Germany, ancient and successful wells of this kind exist, but it is only since the commencement of the present century that they have become general in Europe. In and around Paris there were already, in 1845, not less than eighty deep Artesian wells through the tertiary strata into the chalk. The supply varies very much, but is tolerably constant in the same well. A supply of from 30,000 to 150,000 gallons per day is the common yield, and the expense of sinking is extremely moderate. The sinkings for the supply of Paris commenced at Grenelle, in 1833, and continued till 1841, when water-bearing strata were reached at 1,800 feet, at a cost of £15,000. The first rush of water was at the rate of nearly a million of gallons per day, rising 120 feet above the surface. This continued for some time. Artesian wells are common also in England, not only in and around London, where the geological conditions closely resemble those of Paris, but at Cambridge, through the gault, at Liverpool, through the new red sandstone and elsewhere. The Artesian wells of London are confined to borings through the tertiaries into the chalk, and do not include any sinkings to the greensand. The depth of most of the Artesian wells of London is less than 400 feet, and none of them are much above 500 feet. Some enter the chalk to a depth of 200 feet, or more, and therefore obtain their water to some extent from that formation; while others only reach the chalk, and obtain water from the sands. The tertiary strata pierced are rarely more than 250 feet in thickness. The water, when reached, seldom rises higher than from 40 feet to 60 feet below the level of the Thames high-water mark, and thus considerable expenses are incurred in lifting it. The wells at Cambridge penetrate the gault to the lower greensand at a depth of from 100 feet to 150 feet. The cost is small, and the supply at first rose to or above the surface. It is now 10 feet or 12 feet below. The supply is large and steady, and the number of wells within a few square miles amounts to several hundred. The wells in the new red sandstone at Liverpool and elsewhere are also very numerous, but nowhere very deep. The quality of the water obtained from Artesian wells is a matter of importance. Water passing through a course of strata absorbs mineral matter; but clay is capable either of removing mineral salts from water when they are already present, or yielding various salts if the water be pure;—and thus waters passing through a great thickness of clay may be either remarkably pure or very hard. Of the different minerals found in water there are some that produce hardness, and interfere with the use of the water for detergent purposes, though not otherwise injurious. The alkaline salts render water soft, and thus the large quantity of salts of soda and potash in some of the waters from deep wells does not interfere with their value for household purposes. Carbonate of lime and magnesia, on the other hand, and the salts of iron, though they render water hard, leave it well fitted for drinking purposes. A fifth class of springs is somewhat exceptional, occurring in connection with disturbances of strata, or the presence of metamorphic rock. Such springs are charged with mineral matter and gases, including free carbonic acid gas, nitrogen, hydrogen, oxygen, and sulphuretted hydrogen gas, with a long series of salts of most of the metals. A large quantity of matter is brought by these springs to the earth's surface from the interior, upwards of 16,000 tons weight per annum of various salts being estimated as brought up to the surface from the mineral springs of the central plateau of France. These springs are thermal, or possess a temperature higher than the mean annual temperature of the place at which they emerge. This temperature varies, and sometimes reaches the boiling point. The water rises from great depths, and often in large quantities. These springs are found in all parts of the world, and at all levels above the sea, but they are usually most abundant in mountainous regions, or near volcanoes. The flow of springs is not always uniform, but deep springs are more uniform than those which come from near the surface. For the cause of small and irregular variations we must probably look to the effect of the seasons, but there are marked periodical variations of supply in particular cases that require a more definite explanation. They are known as intermittent springs, and are almost confined to limestone districts. The river Mole, in Surrey, issuing from the chalk, is an example of this kind of spring. It appears abruptly at intervals, which are nearly regular; then runs strongly for a certain period, and as suddenly stops. There probably exists in the chalk hills adjacent, a reservoir filled from the rock above, but with only one outlet, which by some accident of the stratification, curves upwards a few yards before turning down again. So long as the water in the reservoir is not higher than the top of the curved part of the water-way no water can run out, but as soon as this happens, the bent tube acts as a siphon, and when it once begins, continues to carry out the water till it has emptied the reservoir. Such are the phenomena

of springs, natural and artificial, and such the methods adopted by nature and imitated by man to bring the water from the interior of the earth once more to the surface. Let me now point out the application of this great subject to the supply of towns. Some arrangement that shall secure a permanent supply of water for cities is essential. For this purpose most large towns are situated on, or near, running streams. But as the town increases, the waters of the stream become reduced in quantity by the large use made of them, and deteriorated in quality. Wherever there is a large population the sewage is in excess of the demand of the agriculturist, and is conducted into the nearest running water. Thus the waters of the river as it passes each town become smaller and more impure as the need of water becomes greater. Springs are resorted to for potable water, and the river water is only used for washing. Rain-water is collected and stored, but rain-water in a town is rendered foul by the admixture of smoke and vapours, and the supply is of little value. Means have been resorted to from time immemorial to obtain and conduct water from natural sources of supply to large cities. The Romans obtained water in this way from distant places, and conveyed it by aqueducts to the spot where it was needed. Long before the Romans, the Greeks had conveyed water over the surface in closed pipes, taking advantage of the fact that water stands at the same level if there is free communication, no matter how irregular the form and dimensions of the channel. These methods are resorted to at the present day, and with similar success. But a supply of water is not a thing that can be secured easily and without cost. It is an engineering operation for which the aid of the practical geologist must be sought. To obtain pure water for a town, resort must be had to contrivances suggested by, or adapted to, the physical condition of the country surrounding the town, and thus, while in some cases springs may be resorted to, in others rivers or canals may be used; in others, streams may be intercepted at or near their source; in others, mountain-lakes or tarns may be rendered available; and occasionally the rain-fall of a limited district may be collected and stored in reservoirs, whence the water is carried underground or on the surface to a reservoir near the place where the supply is needed. Examples of all these methods may be found in the various towns of England. There are certain limits to the supply of water from springs even the most favourably circumstanced, which now require consideration. Chalk, or loose sand and some sandstones, yield a large quantity of water, replaced from time to time by rain, and the quantity contained in a given area of rock may exceed the quantity required for the town on the surface. But it by no means follows that water is obtainable because it is present in the rock. The loosest varieties of rock are sufficiently close to offer difficulties to the free passage of water; and even from wells of exhaustion the quantity of water removed in a given time is not only incapable of being increased, but the rock is only drained of water within the content of a cone whose base is at the surface and whose apex is at the bottom of the well, and the area of whose base is rarely more than half a mile in radius. The two rocks that yield the largest quantity of water are chalk and soft sandstone; and in neither of these can more than a million gallons per day be expected from a single well. To yield this maximum, such wells must be more than a mile asunder. It could only be from a natural reservoir of large size, existing under pressure in the interior of a rock, that a large permanent supply could be obtained. The expense of Artesian borings, though varying much according to the particular circumstances of each case, is rarely very great. In Europe, the cost of boring has rarely much exceeded 10s. per foot if the depth is under 200 feet, one pound per foot if from 200 to 500 feet, two pounds a foot from 500 to 1,000 feet, and three pounds per foot from 1,000 to 2,000 feet. There are thus powerful inducements at all times to resort to this expedient. On the other hand, it must not be lost sight of that there have been some very costly instances of failure after boring to a great depth in promising strata. When, owing to increased population, a deterioration of the quality of the water, or a diminution of the regularity of the supply, it is necessary to have recourse to some other contrivance than springs, the old Roman method of constructing an aqueduct has been resorted to. Thus, in the case of London, the "New River" was thought a great success. But opportunities of cutting off water are gradually becoming more and more scarce, while it becomes always more difficult to keep a stream clear. Such contrivances gradually cease to be applicable, and only when connected with reservoirs can this supply be recommended. But the construction of a reservoir is a very serious matter, as is known by fatal experience in some recent instances. It is not twelve months since the bursting of a newly-constructed reservoir in the neighbourhood of Sheffield produced a serious loss of life and property. Thus in this mode of obtaining a supply there are important points to be considered. I may state these as, first, the ultimate source of the water; secondly, the storing it in reservoirs; and, thirdly, the conveying it to its destination. Where there is a natural lake of pure water sufficiently large and well supplied to ensure a permanent supply, no better source can exist. The cost of conveyance is often a barrier against the adoption of such plans; but the possession of a natural reservoir, always full of the purest water, is no slight matter. But if there is no lake, natural springs, if sufficiently large in quantity and good in quality, may be made use of. Thus many of the sources of the Thames are powerful enough to be worth taking for the use of London. But to this there has always been a strong objection. The quantity of water entering the sea at the mouth of the Thames is so little more than sufficient to ensure a permanent stream that it cannot afford to lose any tributary, however small. Even when a single spring can be taken it rarely happens that the flow is so regular as to be sufficient without a reservoir. In hilly districts it is usual to take advantage of natural irregularities of the land, and select the head of a valley, where a convenient space can be enclosed. Such embankments are not always dangerous; but a weak point in the stratification may be the cause of an accident, as well as faults of construction. Reservoirs are necessary where the rainfall of a district is to be collected and transferred to a distant spot. In Lancashire and Yorkshire there are several instances of this arrangement. The rainfall of the district, the form of the collecting ground, the rock of which it is composed, and the dip of the rock, are matters of inquiry, and need the knowledge and experience of a geologist. Manchester is supplied from the drainage of a gathering ground of 18,000 acres, at a distance of sixteen miles from the city; Liverpool, from an area of 10,400 acres, twenty-six miles distant; Newcastle-on-Tyne, from 4,000 acres, twelve miles distant; Bolton, from 400 acres, four miles distant. The lecturer, in conclusion, gave a brief notice of the water contents of the various British rocks. The upper tertiaries of England, and the gravel, afford land springs. It is not till we penetrate the lower tertiaries, and reach the permeable sands between the London clay and the chalk, that we obtain large supplies from Artesian borings. The supply from the sands below the London clay is extremely large. Chalk contains an enormous quantity of water, distributed through the mass, though chiefly abundant in the lower part. The lines of flint favour percolation, and occasional spaces in the rock are generally full. At intervals in the chalk are beds that hold back water better than the rest. Water may almost always be obtained by sinking into chalk to a sufficient depth. Wells sunk through the chalk into the upper greensand are not always more successful than those terminating in the chalk; but the gault below the upper greensand being impermeable, water may be expected on reaching this bed. The lower greensands are extremely

wet. Large supplies may be expected from sinking to this rock, but the quantity obtainable from a single well, or from wells within a given distance of each other, is limited. The water of the lower greensand is irony if got near the outcrop, but when filtered through other beds, especially when passing through clay, it becomes more pure. Little water can be got from the Weald clay, nor is the Hastings sand to be depended on. The Kimmeridge clay and the Oxford clay are retentive, and have little value as water-bearing beds. Water is to be got between or even amongst these two bands of clay, but it depends on local conditions, and its presence cannot be assumed without proof. The Portland rock includes overlying stones and an underlying sand, the former of which holds water in crevices, the latter in its mass. The lower oolites contain water, the alternation of clays and open limestones being very frequent. The wells have to be sunk into the rock to its plane of saturation, or even through it to the clay, as the limestone does not otherwise yield a supply. Lias holds back water, so that at its contact with the lower oolite there is almost always a line of springs, and the supply is large and constant. Wells sunk into the upper beds of the lias rarely fail in obtaining water, but the quality is not good. Wells sunk through the lias obtain water from the new red sandstone. Wells sunk in the new red sandstone are almost certain of success; but, owing to the number of close faults, the quantity cannot be depended on, and the water is apt to be salt. The new red sandstone is eminently a water-bearing bed, and the numerous alternations of marl and sand render it possible to obtain water from almost all depths. The magnesian limestone is full of cavities filled with water to a certain level. In the coal measures, and in the mountain limestone, wherever there is an impermeable band between strata, or at faults, water is found. The faulted condition of the carboniferous and older rocks in England greatly affects the water capacity of the rock. The old red sandstone is a variable rock, sometimes containing much water in sandy beds, sometimes in cavities, and, at intervals, between the strata. There is generally a good store of water wherever this rock prevails. In Silurian rocks water is got from faults and fissures, which are very numerous. The limestones of this period are, for the most part, argillaceous, and hold back water. Slates, schists, and all varieties of granite, hold water only in fissures. Where there is a considerable rainfall these rocks sometimes afford large supplies. Little dependence can be placed on them, for the fissures do not communicate readily from one to another. A remarkable instance of successful sinking in granite exists in the island of Jersey, where a sinking was commenced in the solid granite, and was continued to a depth of 234 feet, all compact rock. At this depth a spring was reached which rose seventy feet in the shaft, and has continued at that level.

ELEVENTH ORDINARY MEETING.

Wednesday, February 15th, 1865; PETER GRAHAM, Esq., Member of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Reeves, Miss Sarah, Rectory Grove, Clapham, S.
Reid, Captain Andrew G., 17, Sunderland-terrace, Westbourne-park, W.
Ridley, Rev. N. J., Hollington-house, Newbury.
Templeton, Archibald, 16, Argyll-road, Kensington, W.
Templeton, John, Budge-row-chambers, E.C.
Wallace, Hugh, Chemical Works, New-road, Battersea-park, S.

The following candidates were balloted for and duly elected members of the Society:—

Cockel, George, 77, Onslow-square, S.W.
Creswick, J. Frost, 8, Bloomsbury-square, W.C.
Evans, George, Newton Heath, Manchester.
Kirkman, C. F., 27, Claremont-terrace, Fentiman's-road, South Lambeth, S.
Morey, Samuel Dance, Ironmonger-lane, Cheapside, E.C.
Seymour, J. R. W., 23, St. Augustine-road, Camden New-town, N.W.
Telbin, William, 29, Winchester-crescent, Cheyne-walk, Chelsea, S.W.
Tetley, J. Rimington, 21, Carlton-hill, N.W.
Tonge, George, 3, Lancaster-terrace, Upper Hyde Park-gardens, W.

The Paper read was—

THE CLAIMS OF AUTHORS AND INVENTORS TO PROTECTION FOR AND PROPERTY IN DESIGNS AND INVENTIONS FIRST PUBLISHED AT INDUSTRIAL EXHIBITIONS.

By THOMAS WEBSTER, Esq., Q.C., M.A., F.R.S.

Exhibitions of products of industry, or industrial exhibitions, owe their origin to this ancient Society, the first and, until very recently, the only representative in this country of practical science. The Great Exhibition of 1851, the parent exhibition of the industry of all nations, drew its first breath within these walls; and most here present know that the International Exhibition of 1862 was entirely originated by this Society; and it is not too much to affirm that the seed so sown has borne fruit in exhibitions in the Sister Isle and in other countries, as well as in industrial exhibitions in this metropolis and in the provinces. Whatever may tend to foster and give permanency to such exhibitions is, it is conceived, well deserving the most careful consideration. The reward of the exhibitors by prizes, honorary and pecuniary, is a stimulus not to be disregarded and of a permanent character; but the experience of these exhibitions has produced a strong conviction in the minds of many that, unless something more can be done, unless a more lasting reward and benefit can be ensured to the successful exhibitor, unless he can have property in and protection for the product of his brain as embodied in a particular object, the stimulus will not be sufficient to make such exhibitions permanent and self-supporting. Such exhibitions may, it is conceived, be regarded as marts—as places in which products that have received the approbation of competent judges and the public, may redound to the substantial and permanent benefit of the exhibitor. That this operates most powerfully with the established trader, with the capitalist whose products have acquired or may acquire, through the exhibition, a notoriety, and is productive of substantial benefit, will not be disputed; but the exhibitor who has made his first successful attempt in a design or invention may see others reap all the pecuniary benefit, if not the honour, of that upon which they have bestowed neither time nor money. The real question involved in the preceding considerations, is how can such reward be best secured to each exhibitor, and what should be the nature of the reward? This may be looked upon as pre-eminently a "working man's question;" I cannot but regard it as one of the great social questions of the day, in what manner the artizan, the skilled mechanic, the youth just emerging from our educational establishments, can utilise the talents which he may be endowed, so as thereby to advance and rise to that social position which it should be the ambition of all to attain. The exhibition of a successful product of industry may be the first step on the ladder, but may afford no assistance to its retention, or to the attainment of the second or subsequent step. The question of property in such a product, and protection for that property, without which the name of property is an empty sound, whether as a matter of right or of policy, cannot be evaded; is it just that the author should not have property in and protection for the product of the brain embodied in some practical and useful shape, and given to the world for the benefit of his fellow-creatures?

That the author of such useful product so exhibited has no claim for remuneration has not yet been asserted within these walls, but although a proposition so repugnant to our innate sense of justice may not meet with any avowed advocate, there are not wanting persons who, from the views expressed on the subject, can hardly stop short of such a conclusion. They concede that the author is entitled to such product so long as he keeps it to himself; he may hum the tune, sketch the design, or use the apparatus in private, or in his own closet; but if he chooses to publish it, he has, they contend, by such publication, given it to the world; he has thereby dedicated it to the public, and what the public have once acquired they cannot be deprived of, but may utilise to their own purposes without regard to any claim by or on behalf of any other person.

This is the condition under which, at present, the author of any design, or the inventor of any useful product, publishes that design or product at an industrial exhibition. Is it politic or just that such a state of things should continue? Have not such exhibitors a claim to property in, and protection for, the products of their industry? That many persons may be willing to forego any more substantial reward than the glory of the exhibition is no answer to the just claim to substantial remuneration for the time, labour, and skill, which may be their only capital, expended on the product or design, and then first published. The labourer is worthy of and deserves his remuneration, without which it can hardly be supposed that the stimulus will be sufficient year by year to reproduce a succession of novelties by working men; that is, by the individual members of that large portion of the community who must earn their daily bread by daily labour, whether mental or manual, whose only capital in fact is such labour.

Circumstances wholly beyond control may exclude the mass of the people from acquiring property in land or houses, but their attainments and pecuniary means may be adequate for the acquisition of property in the embodiment of the labour of their brains; beyond this they may be unable to advance without the aid of those who are in possession of the capital of accumulated wealth. It has been often remarked that there would have been no Watt without a Boulton, or, in other words, that the most successful labours of intellect would fall still born without the aid of the possessor of accumulated wealth and commercial influence. How these two talents, the capitals of intellect and of money, can be brought together is a great social question, to my mind the greatest social problem for the elevation of the individual from the ranks of the people. The Industrial Exhibition affords one means of facilitating this union; it is, or may become an "Inventor's Mart," as suggested by that eminent philanthropist Mathew Davenport Hill, in his letter to the Mayor of Birmingham (4th Nov. 1850), "as the best or only practicable means of affording the inventor opportunity of negotiating with the capitalist, and to the capitalist the means of forming a just estimate of the value of any invention."*

It is said by those who object to, or view with little favour, the protection to and property in designs and inventions the subjects of registration or of patents, that each author or inventor should trust to the position which his skill will confer upon him with the public, or with his employer; that, in the majority of cases, he will gain as much, or more, by trusting to that than to the rights or property with which the law may invest him. This may be true; but however true, is it any reason for compelling or constraining him to continue in this state of dependence? Does the remuneration or reward so attained, in the few cases in which it is attained, bear in the majority of cases any adequate relation to the acquisition of the capitalist? Can any reason be assigned why the law should not recognise property in those creations which had no anterior existence, to which as the offspring of the individual brain the right and claim, until published or disclosed, is the stronges possible, namely, the absolute control and possession of its author? This control and possession being parted with, the power of copying and reproducing each object of industry, in spite of and without the consent of the author, is conferred on each visitor to the exhibition without restriction or restraint. Is it for the interest of industrial exhibitions that such a state of things should continue? It can hardly be supposed that the opportunity of exhibiting new designs and products would not be a strong incentive and inducement to the production and exhibition of objects of interest to be so submitted to the judgment of competent persons, if some portion of the benefit to result from a favourable judgment were reserved to the exhibitor. As the law now stands such future benefit cannot be received without the preliminary steps for registration under the Designs Act, or for provisional protection under the Patent Law Amendment Act, 1852, having been taken. The cost of such steps would, in the majority of cases, be absolutely prohibitory; it is one of the prominent defects of our present laws for acquiring property in design and invention, that a substantial expenditure, and one which in many cases is prohibitory, must be incurred before any adequate trial or judgment can be had. The remedy is very simple. Let an Act be passed allowing the place of such Industrial Exhibition to be registered at the Board of Trade or other office; let it be enacted that the author or inventor of any design or invention first published at such exhibition shall be entitled to all the privileges of the laws relating to property in designs and inventions, as from the date of the opening of such exhibition, provided advantage be taken thereof within one month after the close of the exhibition. Under this state of the law fair and reasonable opportunity would be given for the fusion or union of the capital of intellect and that of wealth, and one step in advance would be taken for removing the barrier now placed to the progress of intellectual or skilled labour in any new domain of industry.

The course proposed has the authority of precedent. In the Session of 1851 was passed (14 Vict., c. 8), "An Act to extend the Provisions of the 'Designs Act, 1850,' and to give Protection from Piracy to Persons exhibiting new Inventions in the Exhibition of the Works of Industry of all Nations in One thousand eight hundred and fifty-one;" and in the Session of 1861 an Act, with the same object, and recognising the same principles, was also passed for the International Exhibition of 1862. It may be a question whether the details and machinery of those Acts might not be modified with advantage, but their principle is the same as is now suggested and contended for, and appears to me both just and politic. The working of the first of these Acts, called "The Protection of Inventions Act, 1851," afforded strong evidence of how much might be done towards protecting inventors against their own ignorance. Some plan or system for the identification of the design or invention is necessary. The identification of a design presents no difficulty, but the proper identification of an invention is not without difficulty, and according to the plan adopted in that Act a certificate of the sufficiency of the description of the invention to be registered under the provisions of the Designs Act is a condition precedent to obtaining the benefit of protection for and property in the invention. Although there was no power of refusal of such certificate if the description was adequate, upwards of 70 persons out of about 600 applications, or more than one-tenth, declined to proceed further on the suggestion of myself (to whom, in conjunction with your secretary, Mr. Le Neve Foster, the administration of that Act was entrusted), that, looking at the character of what was proposed it could hardly be worth while to proceed any further with the registration. The principle of the provisional registration then first adopted was carried out in the Patent Law Amendment Act, 1852, the Act of the next session,

* See evidence on Patent Law before Select Committee of House of Lords. Session, 1851.

and is now known as the Provisional Specification, the sufficiency of which is certified by the Law Officers of the Crown. The Royal Commissioners, in their report just issued, have recommended that the application for a patent should be subjected to a preliminary examination as to novelty. The protected exhibitions now contended for would at once bring to the test the merits as well as the novelty of designs and inventions, and thus in effect go beyond what is recommended by the Royal Commissioners as one of the improvements of the present patent system, thus tending to diminish those inconveniences which the Royal Commissioners consider as incident to any patent system, and as the price which the public pay for any patent law. The course now suggested assumes the justice and expediency of some patent law, that is, of some mode of rewarding or remunerating those who are the first to publish new designs and inventions applicable to the industrial arts. That the present patent law admits of, nay requires great improvement cannot be denied; the evils of the indiscriminate issue of patents are seen in the litigation which is the subject of such just complaint. This very litigation is one of the indications of the overwhelming power of capital. Hitherto the patent system of this country has been an unequal struggle between the inventor and the capitalist, in which the latter has had the advantage. In what position would inventors be placed if left absolutely at the mercy of the capitalist, as would be the case if they could acquire no right in their invention to be protected by the strong arm of the law? The real difficulty lies in the mode of protecting the property which the law recognises. Is it a proper course to refuse a recognition of property because of the difficulty of protecting it? Why should not the attempt be made in the direction and manner indicated by the authors of the Patent Law Amendment Act 1852, which, as regards all remedial measures, has hitherto been a dead measure? To pursue this question further would be to travel rather out of the present subject, but these considerations will naturally arise when the claims of the working classes to property in the products of their industry are insisted on. If such property cannot be secured and protected better than hitherto, there will practically be one law for the rich and another for the poor. The Royal Commissioners have recommended that the adjudication of these rights should be left to a judge, aided by skilled assessors; a suggestion which has been repeatedly made and supported by the authority of those most conversant with the working of the patent system.

The promoters of industrial exhibitions will add greatly to the claims which they have on public gratitude, by directing and concentrating attention on the means by which practical and available protection can be secured for the creations which these exhibitions call forth for the first time. The exponent of an existing trade may find his reward and remuneration in the publicity given to the labour and capital under his direction and control, but the ingenious artist or artizan is in a very different position, and must rely on the protection of the law for that independence to which he is entitled.

It lies on the opponents of the views now contended for to show why there is to be property in and protection for a design and not for an invention. The inherent difficulty of the two subjects is matter of degree and administration. It is hardly creditable to our national character that the admitted abuses should be permitted to continue, without even the attempt to apply some of the obvious remedies which have been not only suggested and recommended, but actually provided for by the legislature.

It also lies on the objectors to the existing system, as those who contend that an exclusive privilege is an inconvenient mode of reward, to point out a better. Such a privilege as I endeavoured to show in my last communication to the Society,* was no violation of the principles of free trade, inasmuch as it was only the means, the best hitherto devised, of creating and calling into existence the trade which when so created would be free after the limited terms thought necessary for such creation. If the term is longer than necessary, shorten it. This the system of periodical payments practically does. If the exclusiveness creates any practical inconvenience, let the public have that which the Royal Commissioners recommend that the Crown should have, in the right of purchasing a license for a sum to be settled, in case of difference, by arbitration.

* See *Journal*, April 22, 1864.

Upwards of twenty years have elapsed since in this room, and on every convenient occasion, I have dwelt on the evils of the system, and pointed out the remedies now suggested; those evils are mainly defects of administration. To cut the Gordian knot by abolition is a remedy not likely to meet with favour until other remedies have been exhausted.

The claims of the author, in whatever department his intellectual capital may be invested, are, to my mind, stronger than the claims of the possessor of a transmitted inheritance, however considerations of public policy or expediency may allocate the relative claims of its possessors; and if circumstances exclude any considerable portion of the people from one description of property, do not deny to them the enjoyment of that which they have the power to create for themselves.

DISCUSSION.

Mr. Campin was glad to find that Mr. Webster had touched upon the general question of protection to inventions in his paper, because the special subject of protection at Industrial Exhibitions must be treated as part of the larger question of the amendment of the existing patent laws. It appeared to him that if they gave protection to exhibitors, and then left them to the tender mercies of the Patent Office in the state it was now, they did but little for their benefit, because it was next to impossible for the great majority of exhibitors at Industrial Exhibitions to pay the successive £5, £50, and £100 fees necessary to secure patents under the present system. Moreover, he was disposed to think that the period of one month suggested by Mr. Webster as that within which application for a patent must be made, was wholly inadequate for the purpose, but this was a mere matter of detail. There were some other points not taken up in the paper which he thought would add to the strength of the case. These exhibitions contained not only designs for articles of utility, but also artistic designs. It so happened that, under the Copyright Act, in the procuring of which this Society was mainly instrumental, a man, at the cost of one shilling, could obtain a copyright for his life and seven years after his death, for an original drawing, painting, or photograph—the latter frequently not being the result of any original conception at all. It seemed strange that a man should be able to acquire a property in a production of that class on such easy terms, whilst if he turned his attention to a mechanical improvement or a chemical discovery, he could not obtain protection without incurring the heavy expenses of a patent. All who knew anything of the subject must agree that it was of vital importance to these industrial exhibitions, which were so widely extended throughout the country, that there should be some kind of protection for the original efforts of ingenuity which were there displayed, because he did not think mere honorary distinction would be a sufficient stimulus to promote the permanent success of those exhibitions.

Dr. Pankhurst had listened to Mr. Webster's paper with great interest, and he merely rose to suggest that they ought to distinguish between the general question as to the policy of a patent law and the particular question more especially treated in Mr. Webster's paper. If he understood him aright, Mr. Webster simply submitted the following question—that, assuming there ought to

be property in and protection for designs and inventions, and assuming the policy of the two special acts which were passed to protect such inventions and designs in the case of the two International Exhibitions, on what ground could they withhold such protection in the case of the numerous industrial exhibitions now being held in various parts of the country, the importance and value of which were becoming more and more appreciated? He could not resist the force of the position which Mr. Webster sought to establish. As a matter of justice and right it was quite clear that a man who exhibited an invention under those circumstances ought to be protected by some such plan as that now suggested. That, however, would not relieve him from the difficulties in which he would be placed when the invention, if it were a valuable one, became the subject of contest between himself and the capitalist, a difficulty which he was afraid they could not entirely get over. Whether the plan suggested by the Patent Commissioners might relieve the poor man from the unequal burden of this contest he was not prepared to say. The purpose for which he rose was to express his approval of the simple proposition contained in the paper, and on the grounds of analogy and consistency, as well as plain justice, he conceived some such plan as that suggested ought to be adopted.

Mr. F. J. Bramwell would have been glad, before addressing the meeting, to have heard some of the views advocated on the other side of the question. He would say, at the outset, he was in favour of protection to inventors. Mr. Webster had proposed, and the two previous speakers had supported the proposition, that if the protection afforded to inventions at the two Great Exhibitions in this country was right in principle, the same should be afforded in other exhibitions of a cognate character. The proposition extended to inventions only, inasmuch as designs were already protected by legislative enactment. When they came to inventions it was a matter of greater difficulty. Mr. Webster proposed that the protection should be extended to one month after the closing of the exhibition; but he (Mr. Bramwell) thought the inventor should be required to deposit what might be called a provisional specification with his invention; and unless that document was very carefully drawn there would be considerable difficulty. It might be the case that an invention contained some things which were old and some which were quite new; and if a man said the model he exhibited was the thing for which he claimed protection, and did not at the same time furnish proper particulars, there would be great difficulty in giving him a patent, even if he could afford to pay for one at the present high rate, which, in his (Mr. Bramwell's) opinion, might with advantage be lowered. Allusion had been made to the letter of Mr. M. D. Hill, suggesting that these exhibitions should be regarded as "inventors' marts;" and no doubt that was the very thing required. A man might produce an excellent invention, but at the same time be without the means of introducing it to the world; and even if he had connections which would serve that purpose, he might hesitate to bring his invention before them without protection. The great difficulty a working man experienced was to get his invention considered and appreciated by capitalists. With regard to the general question as to the policy of a patent law, it might be said that those who were opposed to protection consisted of two classes—those who admitted the necessity for a law of copyright, and those (a small class) who went to the extent of advocating the abolition even of the copyright in books, as well as of the patent law. He had formerly heard a well-known Professor of Political Economy advocate the abolition of protection for manufactures, and the retention of it for designs and books; but he had since heard the same gentleman declare the advance which had taken place in his opinions, which now went to the extent of abolishing copyright altogether. There was at least a consistency in this, though how anyone could maintain such a doctrine he (Mr. Bramwell) was unable to understand. There was, however, great inconsistency in those who would give protection to a man who designed a pattern for a carpet, but would give no protection to the man who invented the loom in which the design was woven. These were the two classes who opposed the protection to inventions. What were the grounds on which this opposition was supported? People did not, as a rule, consider the actual manner in which an invention was born and brought to light. They started with the assumption that if anything good was invented everybody would use it if it were not hampered by a royalty. If, however, they looked through the most meritorious inventions, what did they find to be the fact? A specification of the invention was deposited; but there was utter apathy on the part of those to whom the invention would be most valuable, and the patentee was obliged to spend years of time and a great deal of money in order to induce people to take up a thing which was for their benefit. He ventured to say that ninety-nine out of a hundred useful and good inventions had lain dormant for years before any person would take them up. In illustration of this assertion Mr. Bramwell mentioned the case of the fish-joint for rails, which, he said, was now acknowledged to be worth £150,000 a-year to the railways of this country, but it required six years' unremitting exertion on the part of the inventor before he could get the railway companies to use it at all, although the royalty demanded was not large. That was sufficient proof of the lack of eagerness on the part of the public to take up really good and valuable inventions. He firmly believed that patents, so far from being an obstruction to invention, stimulated it. He would not stay to go into the subject of the justice of protection, or of the right of the inventor to it, for political economy did not recognise such things as justice and right, but only acknowledged the force of expediency. He would, however, say that it was expedient for the community that protection should be afforded to inventors. On the other side of the question it was argued—"Do not protect inventors by patents, but let the inventor obtain his reward by the fame he achieves for himself." Others asserted that his reward would come in the ordinary course of trade, through the development of the invention itself, and from the inventor becoming the manufacturer of the article. Dismissing at once the idea that the "glory" of an invention would act as a stimulus to inventors in the present strictly practical age, he would dwell for a moment on the next argument, that inventors should become manufacturers. In answer to this they had the fact before them that the great substantive inventions of this country were made not by persons in that particular class of manufacture, but by outsiders. A man who had practised a considerable business for a number of years had got his mind in a particular groove, and he preferred to go on in the way he had been long accustomed to. He might make some little difference in detail, but he was not the person to look to for great substantive improvements. Taking the great instances of inventions of later ages, they found that Watt, the inventor of the then called fire-engine, was by trade a watchmaker; that Arkwright, the inventor of the spinning mule, was a barber; that the inventor of the power-loom was a clergyman; that the inventor of the screw-propeller (or at least the man who brought it into practical use) was a farmer; and the inventor of the electric telegraph, a musical instrument maker. This was sufficient to show that the great and sterling inventions did not emanate from those who were engaged in the particular trade to which those inventions were applicable, and under such circumstances he asked, what would be the condition of the inventor without protection? A further objection to the absence of protection to inventors was, that it would lead us back again to the old secret systems in the workshops, as

that would then be the only protection an inventor could avail himself of. Crompton, the inventor of the mule, found a ready market for all the yarn he could make, and the question arose how did he make it of that quality? To preserve his secret he barred up his windows and barricaded himself in his factory. Then people climbed into trees to overlook him; others tried to tamper with his workmen, till at last he agreed to dispose of his secret to twelve persons, but only one out of the twelve paid him the price agreed upon. That was a fair example of the evils that would arise if protection were abolished. A favourite argument against the patent law, as it now existed, was, that out of the 3,000 and odd patents applied for every year, more than 1,000 were allowed to expire at the end of six months, and thus became the property of the public; that at the end of two years and a half more another 1,000 dropped off; and that, comparatively, few out of the 3,000 paid the final fee of £100 for the full period of fourteen years. He believed it to be the fact that only about 6 per cent of all the patents taken out were carried to the point of paying the £100, and he was aware that was a stock objection against protection. But in his opinion the public were greatly benefited by such a state of things, as they had the advantage of the publication of this large number of inventions; and as the patents lapsed it could not be alleged that they were any obstruction to progress. He thought, however, the existing patent law was capable of great amendment and improvement. The great point to be enforced was, that every inventor should honestly and truly specify what his invention really was. He assumed the law never meant that it should be otherwise; but it might truly be said "the law was made of none effect;" inventors sheltered themselves under the elastic term "combination," which was in some cases carried to such an extent as to shut out many really useful and good inventions, inasmuch as there was a fear of infringing that which had already been specified under the covenient term "combination." He, considered unless a man specified what he wished to be protected in such definite terms as could be understood by persons of ordinary intelligence reading the specification, he ought not to receive protection, and if this were done a vast amount of the objections they had heard against the patent laws would be done away with.

Mr. W. Hawes said it was very difficult to treat a subject on broad and general principles, after it had been reduced by each successive speaker into a criticism of details. Those who objected to the patent laws justified their objections on the principle that the operation of these laws was unjust to the community, that they were calculated to deter and not to stimulate invention, and were in every respect injurious to the interests of the public. He took up the question on the broad principle whether the public really gained or lost by the operation of the patent laws. It was matter of history that the great majority of inventors were amongst the most unsuccessful men in the world, and that the parties who really benefited by the patent laws were those who speculated and traded in other people's inventions. The patent laws were evaded in every step of their progress; moreover, they could not be supported on the principles of political economy. He had been surprised at the remark of the last speaker, that political economy was based neither on right nor justice. Political economy, however, was a science of modern days, which had risen with civilization and with the progress of knowledge, and to say that that science was based neither on right nor justice, was an expression of opinion which he hoped would not be supported by the enlightened and educated classes of the kingdom. The whole liberties of the country were based upon the truth of political economy, and if those principles were not those of truth and justice, he would ask what principles they had to guide them in the administration of law and equity throughout this realm? They had had paraded before them a great many objections to the patent laws, but those objections had not been urged upon sound principles. They had been told that there was protection by law for a design, while the machine by which the design was produced was unprotected. He thought such a statement was made in ignorance of the real state of the case. The law of copyright in books had been compared with the patent law. Now what was the operation of the law of copyright? The law of copyright in books prevented any one reprinting a book word for word as it was issued from the press by the author, but it did not prevent a man getting all the information he could out of the book and reproducing it in another form. He might use this information in every possible way, so that he did not absolutely reprint that identical book, or such a colourable imitation of it as would mislead the public. There was no similarity whatever between that and a law which said a man might take out a patent, dividing his claim, as had been explained by the last speaker, into five or six parts, and then if one of those parts were applied to a purpose quite dissimilar to the original intention of the patentee, it could be made the subject of legal proceedings. The two things, copyright in books and the patent law, were very dissimilar; and they had the authority of the first engineers, and of men most distinguished for discoveries in modern times, that improvements were impeded and checked by claims being made upon them for royalties for the use of certain parts of inventions, which it was said belonged to patents taken out for entirely distinct purposes. The designer of the *Great Eastern* steam-ship, in the application of modern improvements to uses to which they were never applied before, was perpetually fettered by claims for the alleged infringement of patents. He therefore said the patent laws checked invention, and did not benefit the real inventor. The case of Watt had been referred to, but it was notorious that he was nearly ruined by constant litigation in defending his patents, and it was only by the pecuniary assistance he received from Boulton that he was kept from sinking under the difficulties to which in this way he was exposed, by the operation of a law now supported in the interest of inventors. Many of the most important discoveries had never been patented. Gunpowder, paper, and glass, among many others, were discoveries which were never patented. These discoveries were made without a patent law, and the best practical inventions in all ages were those which had never been made the subjects of patents. Now what was the origin of the first patent law in this country? It was nothing more than an agreement between the throne and the subject to perpetuate monopolies. Previous to the time of James I. patents were granted by the Crown on certain pecuniary conditions, which led to enormous abuses. The people resented that state of things, and the result was the limited monopoly afforded by the patent laws. Patents were, however, admitted to be a monopoly, and he believed that no kind of monopoly whatever was useful or beneficial. The argument now used in support of the patent laws was the same as that urged in favour of the exclusion of foreign corn from this country. Nevertheless, the result had shown that unrestricted competition was a good thing for the community at large. Would they wish to go back again to the monopoly in corn by the farmers of England? He might illustrate his views at any length in this way. They must look at it, however, as a great national question, as a people's question, and not only as an inventor's question. Let them look at the statistics relating to patents. The 3,200 patents applied for in the year were reduced to 1,900 at the end of the first period; at the end of the second, or £50 period, they were reduced by 539; and proceeding further, they found that out of the whole number of patents taken out, but 140 were considered worth the payment of the £100 for the continuation of protection through the whole term of 14 years. They might look at the question in another point of view. Patents were frequently taken out for the purpose of advertising articles as being produced under letters patent. People

were apt to think a patented article must of necessity be superior to others, and he believed this was a means often resorted to to puff an inferior thing; but this would, of course, last only a limited time, when the patent was allowed to drop. This was the history of all but a small fraction of the patents taken out. To revert for a moment to the paper now before them, it was proposed by Mr. Webster to give some kind of protection to inventions brought before the public in the industrial exhibitions which were now taking place all over the country. If there was any good at all in the patent laws they would not stop where they were. If they encouraged the working classes of the country to expose their productions to the public eye in those exhibitions, he did not see how they could stop short of giving them an adequate amount of protection for those productions. Having passed Acts for the wealthy exhibitors in 1851 and 1862, they could not refuse the same protection to the exhibitors at these industrial exhibitions. The views of the late Mr. Brunel and also of Sir William Armstrong on the subject of the patent laws were well known; and although he (Mr. Hawes) had not always advocated the principles he now supported to the full extent he now did, yet he had done so in this room for the last fifteen years. But the supporters of the patent laws, feeling the difficulty of maintaining the existing laws, suggested, as a means of meeting the evils daily arising from the flood of sham and useless patents, that there should be such an examination of inventions as to ensure that no patent should be granted except for that which was absolutely new; but who was to be the judge to say whether a given mechanical, chemical, or scientific process was new? If such a tribunal as that were established, it was probable that many important discoveries would be nipped in the bud, and would be condemned as worthless. Where then were the persons to be found to say whether an invention was useful and also new? The only alternative left was to make the cost of patents so small that every one could obtain them. Looking, then, at all the difficulties of this important question, considering it from a national and not solely an inventor's point of view, he believed the time would arrive when all would admit that the patent law was an injury both to the public and to the inventor.

Mr. Bramwell explained, that what he intended to say was not that political economy was not based on truth and justice, but that it was not its province to deal with abstract justice or abstract right, but only with the question of public expediency.

Mr. Leverson was glad that the question had at length been referred to general principles by Mr. Hawes, for, the principle of giving property in inventions once conceded, all must concur in the admirable suggestions put forward by Mr. Webster in his able paper, but there was no use shutting our eyes to the fact that the real question to be determined was should any patent laws exist at all. And here he begged to state that, although ten years ago he had written upon this subject without hesitation, and with all the positiveness and dogmatism of a young man, he now, while entertaining precisely the same views, expressed them with greater diffidence, and entertained far more respect for what had to be said on the other side.* He begged at the outset, though agreeing with Mr. Bramwell in the main, to express his entire dissent from what he said on the subject of political economy. It was to political economy we owe our knowledge of the reasons for permitting any right of property at all, and it was to the principles and teachings of economic science to which recourse must be had, not only to support a property in thought, but all kinds of property. In answer to Mr. Hawes and his appeal to general principles, he would urge that all rights were the creatures of the law, and that the object in giving a right of property in the produce of labour was to give an inducement to labour, and that but for this we never could have emerged from the rude state of barbarism; moreover, the greatest inducement to labour, and at the same time the least, *i.e.*, the cheapest, was to give to the producer the right to possess and to dispose of the produce of his labour. The law said if any one actually manufactured an article it became his property to keep or to dispose of—if he sold his labour that he should be entitled to his wages; the principle then of the right of property in the produce of labour once established, it lay upon those who desired to withdraw any particular produce of labour from the operation of that principle to establish a case for doing so. Did they propose any mode of remunerating the inventor for his invention, cheaper to the community, or affording a larger inducement to labour? No, they proposed, instead, to abolish the patent laws; that is to say, to destroy the property altogether, and this on the plea that the present laws were detrimental to inventors themselves. Of that the inventors were the best judges, and the answer to it was the immense number of patents of which we had heard. But we were told that it was not the inventor who was benefited by the present laws, but persons who had never invented at all. He admitted there was a great amount of truth in this, but the meaning of it was that the inventor, having had conferred on him a property (of which the abolition of the patent laws would deprive him), owing to causes presently to be mentioned, chose to exercise his right of property by parting with it; the right to dispose of his property being, he (Mr. Leverson) submitted, an element in its enjoyment. But what was the real cause of his having to dispose of his property for, often, so inadequate a consideration? Not the law, which gave him the property, but the defects in that law which only gave it on costly terms, and the still greater defects of that law—its expense, vexation, and delay in preserving to him his enjoyment of that property. Reference was made to certain grand inventions which had never been patented, but this certainly was not an argument upon general principles, and was best met by that great mass of inventions which were patented. As to the costly machinery of the patent office, this was paid for by the patentees, and not only so, but there was a large overplus; he claimed that the fees taken from inventors should be only sufficient to cover the expense of registration, and of affording that special kind of protection which the nature of the case demanded, and the necessity for which was one of the natural difficulties of the case. And here he begged to deprecate an appeal to the history of the patent laws, or to the history of any other law as being supposed to afford an argument either for or against it. This was not a question of an agreement between the crown and people; the question was not one of history, but of social science and of jurisprudence. Was it or was it not desirable in the interests of society that this or that right should be granted by the law? This appeal to antiquity was the more to be deprecated from the peculiar mode in which our laws and civilisation had grown up. Our neighbours (the French), having an accumulated mass of evils, got rid of them by overturning the social fabric and commenced building up a new one; we, on the contrary, as we progressed from barbarism, amended here and amended there, leaving or retaining such bits of good (and often a great deal of bad) as had been introduced into the mass, and in this way the patents granted by the Crown having supplied a want felt by society, viz., the right of property in inventions, were retained. That this peculiar species of property, viz., property in thought, was more difficult to protect than any other was true, but the way to remedy this was not to say, "We won't give any property or protection at all," but to devise proper means to give the most effectual security possible. The real difficulty—the real defect—lay in the law, and to remedy this, reliance must not be placed on the lawyers—they would afford no help; but here the public

* "Copyright and Patents, or Property in Thought." By Montague R. Leverson.

must help themselves, and in this the Society of Arts could do great service. By the present vexatious, dilatory, and expensive system of procedure justice was not done, the expense, vexation, and delay being often a greater injustice than the original wrong. If a rational system of litigation were to be established, it would be found that the greater part of the evils complained of in this, as in every other department of law, would disappear, and all or nearly all Mr. Hawes's objections to the patent laws would vanish, they being, in fact, the results of the defects of legal procedure rather than of any real difficulty in the nature of the subject. If, instead of the present system of barbarous jargon, absurdities and fictions, when A complained of B, he were to complain in person to the judge, and the judge were to summon B before him, once the parties brought face to face before the judge, nine out of every ten disputes would be immediately determined. With regard to patents, the cry of monopoly was raised. Of course, all property was a monopoly. If this coat was his, and he was to have a monopoly of wearing it, so did an invention belong to the inventor, and he ought to have a monopoly in it. The owner of the coat had a right to the monopoly—the owner of the invention had a right to the monopoly also. The law, and the law alone, gave the one, and he hoped the law would never cease to give the other.

Mr. MURPHY, as one who had been largely engaged in the organization of Industrial Exhibitions in the metropolis, desired to express his deep obligations to the Society for affording this opportunity of ventilating a question of so much interest and importance at the present moment. He considered that the principle which was applied in the case of the two Great Exhibitions, and which was about to be extended to the Dublin Exhibition, ought fairly to be applied to Working Men's Exhibitions. At the present time inventions shown at these Industrial Exhibitions were so entirely without protection that any person was at liberty to take a sketch and make the best use he could of any article there exhibited, from which, however, the articles in the Great Exhibition were protected by a special enactment of the legislature. He wished to state that a deputation on this subject to Mr. Milner Gibson had been received in a manner which led to the belief that the measure of protection sought for in these cases would be afforded.

Mr. G. F. WILSON, F.R.S., said the arguments on both sides of the question had been so fully entered into by Mr. Bramwell and Mr. Hawes, that he would only refer to one point on which he especially disagreed with the latter gentleman. It had been his fate to have been thrown a good deal in the way of patents, both as a patentee himself and as having received a good deal of annoyance from the patents of others; and with a full knowledge of obstructive patents in his mind he would say that a great number of inventions could never have been carried out to anything like perfection without some such protection as was afforded by patents. Therefore, on the broad view of the subject, he considered patents were a benefit to the community. Then there was the matter of the temptation to work in secrecy. In many trades, some years ago, secret working was carried on to a great extent, and the evils of this were well known. If protection were abolished this system would no doubt be returned to, and there were many processes, such, for instance, as the manufacture of magenta dyes, which could have been thus carried on. How much advantage would the public have lost by this in the way of improvement? There would not then have been, as had now been the case, many minds brought to bear upon the subject, and the variety of colour and improved processes now in use would have long remained undiscovered.

After a few words from Mr. MURDOCH,

Mr. CLARKSON suggested that a useful hint on this subject might be gained from the practice of other countries. In France a patent could be taken out for £4, in Belgium for £10, and the American system had been found to work well generally. He could confirm the statement of Mr. Bramwell as to the difficulty of getting an invention practically before the public, inasmuch as he had himself been fifteen years trying to introduce an invention, and had been obliged to obtain a prolongation of the protection. In one instance in particular, in which a saving of many thousands a year could be effected in a particular branch of manufacture, the invention was as yet only in the infancy of its practical application. He confessed he had no great faith in "glory" as a stimulus to invention.

The CHAIRMAN, in closing the discussion, said he would trouble the meeting with very few observations. He might say that the paper before them originated in the general desire that was entertained that the working men who exhibited their productions at the different exhibitions in London and in the country should have protection for the novelties they placed before the public. Such a desire was only reasonable, and he thought the legislature was in duty bound to accord that provisional protection at such a cost as would be within the means of the working classes. The discussion had naturally extended to the consideration of the general question of protection by patents. Mr. Bramwell, he thought, had pretty nearly exhausted the arguments in favour of patents, and some of the objections of Mr. Hawes were doubtless worthy of consideration. He would confess that, as far as inventors were concerned, he believed few reaped anything like a proper reward for their inventions, and in the generality of cases he thought they did not benefit by the patent law. But if the question were asked, who did get the benefit? his answer was, the public; and if they could not support patents on public grounds, the sooner they were abolished the better. It required more than mere invention to give a thing stability. It required experiments, frequently of an expensive character, and a large outlay of capital before it could be even fairly tested, because tests which succeeded on a small scale often failed when applied commercially on a large scale. The assistance of the capitalist would not be given, if it were not for protection; indeed, the most important inventions this country had witnessed would never have been brought to light but for the patent laws. He believed it was the invention of the country, the capital which developed it, and the protection which the patent laws afforded, which enabled us so greatly to multiply our resources and extend our enterprise. They must not be unmindful of the obstructions which stood in the way of the practical application of many great inventions. For instance, a manufacturer of a certain textile fabric, employing a thousand looms, might be told by an inventor that he could give him machinery that should weave for 2d. a yard what he now paid 10d. a yard for. The reply of the manufacturer would be, "What am I to do with all my old plant, in which a great portion of my capital is invested? Besides, I don't believe it is practicable to do what you say." The inventor would go to another manufacturer and meet with the same reception. Thus the invention might lie dormant for years, until some one, probably unconnected with the trade, found the capital to bring it into operation, and made a large profit out of it. But it was not to be supposed that this would be done without the protection of the patent law. He thought the expense of provisional protection should be 5s. instead of £5, and to a poor man, to whom £1 was of consequence, it might be reduced to 1s., especially when they saw how many patents fell through before six months expired. They had been told of the great expenses in connection with the Patent office, but these were paid by inventors, and not by the public, whilst the public reaped the full advantage of the great number of specifications which came before the world when the patents lapsed. He concluded by moving a vote of thanks to Mr. Webster for his very able paper.

The vote of thanks having been passed,

Mr. WEBSTER expressed his acknowledgments for the way in which his communication had been received. He

must say, as regarded the speech of Mr. Hawes in opposition to patents, which was characterised by that gentleman's usual ability in anything he undertook, he could not but look upon it as a tissue of fallacies throughout. Was there any analogy between the protection of an invention and the maintenance of restrictive duties on the import of a produce like corn? Was it not a delusion to talk of a comparison between that which gave a privilege for creating a thing, and that which caused the exclusion of a commodity already existing such as corn? The so-called monopolies which were abolished by the Act of James I., were monopolies in the sale of certain well-known articles, which were then restricted to certain privileged persons, but there was no analogy between the two cases. One defect in the present law was permitting actions too readily against mere sellers of articles. Neither the seller nor user, except he was in collusion with the manufacturer, ought to be subject to action for infringement, because there were many innocent usings and sellings, and no doubt, in many cases, black mail was levied on such parties rather than stand the fight of a patent cause in the Courts. One of the improvements which he hoped to see in the law was, that there should be no action for infringement, except under the fiat of some competent person that there were reasonable grounds of action. They had been told about the obstructiveness of patents, and that in many cases they were used merely for puffing an article, but they must be considered a rather expensive mode of puffing. In reference to the argument drawn from the fact that so large a proportion of patents were allowed to lapse without running their full term, it must be remembered that persons having patents often did not go on paying because they might have improvements which would render the former patent nugatory; and so it was often no argument against the value of an invention to say that the patent was suffered to lapse. Then again, it was argued that the invention of gunpowder was not patented; but everything must have a beginning, and the fact that gunpowder, glass and paper had not been patented was no answer to the rapid progress that had been made in various manufactures under the protection of the patent law. Nothing could be more true than the statement that most of the great inventions did not emanate from the persons engaged in that particular manufacture. A person who had a large capital in machinery was generally the last to desire improvement; he would be inclined to suppress invention, and that was one form of obstructiveness which inventors had to contend against. He thought what was wanted in the present day was a concise history of the inventions that had grown up under the system of patents, which would form a valuable contribution to the study of the subject. With regard to the preliminary examination of inventions, he thought in many cases it would save imaginary inventors from the consequences of their own ignorance, though the power of rejection should not be absolute. He hoped this subject would be followed up in the interest of the working man, for it was a working man's question. They could not expect a reform in the patent system to come through the lawyers any more than through the capitalists, as both classes were interested in maintaining the existing state of things.

Proceedings of Institutions.

Knutsford Society, for Readings, Music, and Lectures.—The committee having found that the establishment of penny readings in the town has been attended with more success than could reasonably have been expected, have made arrangements for a course of lectures in addition to the readings. Amongst the subjects are—"Freedom's Battle; or, the Struggle of a Thousand Years," by Mr. John Johnson, of Liverpool; "Jerusalem, past, present, and future," by the Rev. John Broad, St. George's, Newcastle-under-Lyne; "The Curiosities of Insect Structure," by Mr. John Withrington, Blackburn; and "The Bow of the Past, and the Rifle of the Future," by the Rev. Samuel Doria, of Wigan. The admission is, in all cases, one penny each, but tickets for reserved seats, at sixpence, are also issued. No donations are solicited, because the system of penny payments for admission renders the Society self-supporting, and avoids the objectionable features of free lectures and readings.

Marlborough Reading and Mutual Improvement Society.—Mrs. Balfour recently gave a lecture here on "Illustrious Prisoners, and what prison hours have done for the world." Out of the wide field comprised in the title, Cervantes, Sir Walter Raleigh, John Bunyan, and a pathetic history of the escape of Lord Nithesdale from prison and a scaffold, were the chief subjects chosen. The lecture appeared to be much appreciated by the audience.

Metropolitan Association for Promoting the Education of Adults.—The second annual meeting of this association was held on Wednesday, the 8th inst., at the house of the Society of Arts. Earl Granville, K.G., President of the Association, occupied the chair, and was accompanied by Lord Feversham, Sir T. Phillips, Mr. W. Cotton, Archdeacon Utterton, Revs. H. White, Wallis, Mr. F. S. Powell, M.P., Mr. B. Shaw, and others. The report showed that the work of the Association had greatly increased during the past year. The number of candidates in the elementary examinations had been more than doubled, while in the examinations in religious knowledge, held under the direction of the Bishops of London and Winchester, the advance had been still greater. Several clergymen and managers of schools and institutes had borne testimony to the value of the Society's operations. During the year a number of educational classes, on the principle of those of the London Mechanics' Institution and City of London College, had been established in the district. Female education had formed an important part of the work of the Association. Conferences on subjects connected with adult education had been held, which had been well attended. In order to bring the subject of Adult Education under the notice of the public generally, meetings had been held in different parts of the metropolis, at which deputations from the Committee attended to explain the operations of the Association. Physical education had engaged the attention of the Committee, and at a *fête* held at the Crystal Palace, on the 27th of June, prizes to the amount of twenty guineas were awarded to successful competitors in athletic sports, and delivered to them in the orchestra of the Crystal Palace, by Mr. Harry Chester, the Chairman of the Committee. The receipts of the Association amounted to £184 0s. 5d., and the expenditure to £190 3s. 11d. The report concluded with an earnest appeal for increased support. Earl Granville said that sitting in that room, where he had often had the pleasure of meeting a portion of the company then present, he could not help adverting in few words to the Society of Arts, to which the room belonged. For more than a hundred years it had been at work encouraging education in different forms throughout this country. There was no doubt that its proceedings had been marked to a singular degree by that stubborn energy which was the characteristic of the English nation; and that a great amount of benefit had been conferred on the arts and manufactures of this country by that society. It was soon after the Great Exhibition of 1851, that the step was taken by the Society of Arts of forming a union of institutes throughout the country, and, when thus united, it obtained for them the legislative powers by which their property was protected. It then became desirable to enlarge and liberalise those Institutions, and make them more active, more agreeable, and more instructive to those connected with them. It was found that, in order to give full effect to the educational objects of those Institutions, it was also necessary to establish some system of examinations, and he thought this was a

most wise step on the part of the Society. He believed the Metropolitan Association (which was in Union with the Society) was established because it was found that, thickly populated as this metropolis was, and great as was the amount of activity that prevailed among all classes, yet the attendance at these examinations was much less numerous than in other parts of the kingdom. The objects the Society had in view appeared to be to give an opportunity to those who were chiefly engaged in labour to redeem time mis-spent, or to continue the advantages of education, which they had only been able to receive up to a limited period of their lives. The advantages of education were said to be so obvious that it was unnecessary to urge them; still he would repeat his belief that knowledge was of the greatest advantage to every class of the community. He remembered that the late Prince Consort, when he used the words "knowledge is power," always added, "and enjoyment too." The Prince Consort, coming to this country as a foreigner, was in a difficult position. It was perfectly clear that if he had arrived here a perfectly idle and uninformed man, he might perhaps have been powerful for harm, but he would have been powerless for good, whereas they were aware that every year he gave increased encouragement to the social institutions, and aided the prosperity of this country. He had had the opportunity of observing his Royal Highness for many years, and it was quite remarkable to see what knowledge he possessed of almost every science in every department, and how he increased his enjoyment of everything that related to the fine arts, as well as to more practical pursuits. With regard to enjoyment, he remembered a great friend of his (Earl Granville's)—one of the best informed men in the House of Commons—telling him that his great love for reading, and his great pursuit of knowledge, had its origin in his poverty. He found reading so much cheaper than other amusements that he was driven into it, and not only had it taken him into the position he had attained, but it had given him the highest enjoyment, which no other pursuit afforded. The report alluded to the progress that had been made, but when it was considered that the metropolitan district contained three millions of inhabitants, a very small fraction of persons would be affected by the operations of the Society. Taking into consideration, however, the large number of persons who by their position were necessarily excluded from these examinations, and considering also the very natural reluctance of older men to subject themselves to attending examinations in competition with younger persons, they would not find the state of things nearly so discouraging as it appeared to be. He did not, at any rate, wish to discourage the older persons from devoting a great deal of time even to the elementary portions of education. Not long before his death, Lord Lyndhurst consulted Mr. Gladstone as to whether he was using the best Greek dictionary, as he was reading Homer, and derived great enjoyment from it. With regard to what was suggested as to female education, he could not but express his great pleasure at this portion of what the association had done. He thought it was highly encouraging to see that the Princess of Wales had followed the example set to her by her illustrious mother and father-in-law, and had become the patroness of an Association such as this. The report made a touching appeal for help to so young a society and so useful an institution. He believed it to be unnecessary for him to say anything on the subject, because the fact that they were tending to stimulate education—that they were trying to urge young men to improve their prospects in this life, and, as he firmly believed, to fit them for another world—would be their strongest claim to assistance. He did not think Government could do much to aid this movement, but the principle of giving clerkships by examination certainly did exercise a valuable influence. In the department over which he had the honour to preside two candidates from the Society of Arts' Examinations had been successful, and in another department there was a much larger number, and he was happy to state that every one of those persons was doing well, and some excellently well. Some difficulty had been raised against the system of competition; but he could vouch, from his own experience, that there was no comparison between the competitive and probationary systems. He might mention also that employers of labour attached great value to persons who had distinguished themselves in examinations of that kind. He concluded by expressing his hopes for the continued success of the Association. Archdeacon Utterton, in moving the publication of the report, recommended the system of examination as a means of inducing young persons to concentrate their attention on particular subjects. Sir Thos. Phillips seconded the resolution. On the motion of Mr. Powell, M.P., seconded by Mr. Shaw, the officers for the ensuing year were elected; and a vote of thanks to the chairman brought the proceedings to a close.

Richmond Young Men's Society.—A most valuable encouragement has recently been given to this Society, by the kindness of Earl Russell in consenting to become its president. On Monday, the 16th January, a deputation of gentlemen connected with the Society, and consisting of the Rev. Mr. Ingram, the Rev. Mr. Webster, J. G. Bohn, Esq., W. J. Maxwell, Esq., H. Hill, Esq., C. Ellis, Esq., and others, waited upon Lord Russell, at his residence, Richmond-park, for the purpose of presenting him with an address of thanks. The deputation having been introduced by Mr. Bohn, Mr. Gouldsmith read the addresss, which was elegantly illuminated. In addition to a cordial expression of thanks, it briefly described the main objects of the Society, which are "the mental and spiritual improvement of its members by means of a library for circulation and reference, reading-rooms, classes for the study of the Scriptures, elocution, music, English and French literature, &c." and also paid a tribute to the eminent services of his lordship in the cause of social and political progress.—Earl Russell, in reply, said "he was most happy to accept the presidency of the Society, and felt it an honour to be connected with so valuable an institution. It was a great motive with him, in undertaking this position, that the society regarded the religious interests of its members of paramount importance, and attached so much value to the circulation of a wholesome literature. It was also a source of great gratification to him that Richmond was likely to be benefited as Manchester and other towns had been, by the exertions of such a Society. He ventured to hope that the future labours of the particular institution represented by the deputation would be pregnant with the happiest results to this neighbourhood and the country at large." His lordship afterwards intimated his intention of appearing publicly in the capacity of president of the Society, at as early a date as should be found convenient. The fourteen years of the establishment of this Institution have witnessed a progressive increase in the number of its members (now scarcely fewer than 300), and a corresponding augmentation of its means.

ART SCHOOLS AND ART INSTRUCTION.

The following is the substance of the minute of the Committee of Council on Education, dated 9th February, presented to both Houses of Parliament by command of Her Majesty. It will be of interest to the Institutions in Union, as it opens up the means of aiding night classes for drawing, without requiring any connection with a School of Art:—

My Lords having given their attention to the report and resolutions of the select committee of the House of Commons on Schools of Art, to the suggestions made by individual members of the committee, to the evidence of the witnesses, and the letter of Mr. A. Beresford Hope, acting on behalf of certain art schools, as well as to

various memorials and documents which have been sent to the Science and Art Department from the local schools of art, observe that the resolutions of the Select Committee offer no recommendations respecting elementary instruction in drawing given in schools for the children of the labouring poor, or given to the masters and pupil teachers of such schools, or to adults taught in night classes, objects of the first importance which may be promoted independently of special Institutions constituted as Schools of Art.

All these objects having been matured by the Science and Art Department into a national system of art-instruction, have been supported by Parliament for several years, and have taken root as an effective and successful system which it is desirable should not be impaired, whatever changes it may be expedient to make in the administration of local Schools of Art proper.

The Science and Art Department has steadily borne in mind that national improvement in manufactures can only be secured by the existence of a healthy demand and supply of such manufactures, arising from the improved taste and knowledge of all classes of the community, and that this result could most effectually be obtained by placing the greatest variety of means of instruction within the reach of all as far as practicable. Elementary drawing is taught especially to children of the poor, and to adults in schools and Institutions which are not Schools of Art. Drawing, painting, and modelling are taught in schools of art; whilst fine examples of art-workmanship of all ages and countries and styles are exhibited for public instruction in a central museum which is open both day and night, under a more liberal system than exists, at present, in any other capital in Europe.

It has been the consistent aim of the Department so to regulate the expenditure of public money on these several means of instruction that, if it should be the pleasure of Parliament to reduce or withdraw its votes in any direction, the public might be induced to supply instruction in art by municipal or voluntary action.

The report of the Select Committee confirms generally the soundness and success of the department's policy, and suggests modifications which are calculated to extend the principles of self-reliance, and to simplify the relations between the Schools of Art and the Department. The principal recommendations of the report refer to local Schools of Art, in reference to which the committee recommend—(*a*) That local schools of art be left to establish themselves wherever they can take root, and to extend their operations to all classes of society, and to charge such fees as their managers may think suitable. (*b*) That no further grants be made in aid of buildings, renting, or repairing Schools of Art. (*c*) That no further grants be made in aid of purchasing examples to Schools of Art. (*d*) That it be a condition of Government aid, that a public examination of every aided School of Art be held annually, through the agency of its local committee, and that the results of such examination should be reported to the Department in such form as the Department may prescribe. (*e*) That fewer prizes and no medals should be given by the central Department, on local examinations of aided Schools of Art.

These suggestions clearly indicate the opinion of the elect Committee to be that Schools of Art should chiefly rely on their own resources and local exertions, being relieved from any Government control, and free to work according to the wishes and peculiar wants of each locality. This view entirely accords with the policy of the Department, which has always aimed gradually to render the Schools of Art less and less dependent on direct state assistance, and to make them self-acting and supporting. In 1851 the Parliamentary votes, paid direct to the local Schools of Art, amounted to £6,850 for 17 schools having 2,842 students, being an average cost of £2 8s. per student, whilst in 1863 the corresponding payments to the local Schools of Art amounted only to £4,005 for 90 schools, having 16,480 students, being an average of only 4s. 10d. per student. Had the Select Committee recommended a return to the system of payments on teachers' certificates the whole charge on the Department in respect of them would have been only £2,836. These payments are exclusive of the cost of the National Art Training School, annually amounting to £4,450, of payments on results for elementary teaching £1,104, on prizes £2,461, on prize-studentships £1,063, and on art pupil-teachers £1,961, objects which have exercised a most important but indirect influence on Schools of Art. The Department having thus succeeded in reducing the direct payments, the Select Committee has now recommended the abolition of most of the indirect sources of aid, and the conversion of all payments into one capitation grant to each school of art. There was a great advantage in this variety of aid, because such aid could be modified from time to time in any directions experience might suggest. The mode and extent of its application were under control and new applications of it could be introduced. My Lords consider that these various kinds of assistance and stimulus could not be wholly withdrawn without inflicting a serious blow on a system which by general consent at home, and especially abroad, is considered to have worked well.

The Select Committee having affirmed the public utility of Schools of Art, it must have been their opinion that these schools have so far established themselves in the country that they must have nearly reached the point of self-dependence, and would not be imperilled by the suggested changes. My Lords would themselves have hesitated to say that this point has altogether been reached at present, but they are not so convinced of the contrary as to assert that the modifications recommended by the Select Committee would be permanently injurious to the schools or might not be safely tried to a great extent.

My Lords entirely agree with the Select Committee in thinking that Schools of Art should be left to establish themselves wherever they can take root, and to charge such fees as their managers may think suitable. The obligation of teaching elementary drawing in poor schools or to artisans at 6d. a-week, as conditions of recognizing a School of Art, will therefore no longer remain in force; and the masters of the art schools will thus be relieved of the obligation of performing work which has been called unremunerative. A local School of Art, as distinguished from adult night classes for drawing, will hereafter be defined simply as an Institution which is applied exclusively to the teaching of art at all times, and not to other purposes. Every place will be the judge of its own wants, and the only condition for receiving any direct payments from the State will be that there must be night classes for artisans open three times a-week at fees within their reach, the amount being settled by the local committees, and that the teachers must have taken from the Department a certificate of competency either of the second or third grade. Mechanics' Institutes, Literary Institutions, and schools for general education will be free to establish night classes for adults to learn elementary drawing without incurring the expenses necessary for the special premises or outfit of a School of Art.

My Lords regret that the Select Committee recommended all aid to be withdrawn towards buildings for Schools of Art. The provision of a suitable building is the greatest of all difficulties in establishing such a school; the special requirements for proper lighting by day and night rooms for art instruction are rarely met with in existing structures, and it is generally necessary to construct rooms specially. Out of the 90 existing schools, very few indeed are quite suitable, and by far the cheapest are those in which a moderate aid from the Department has been obtained and the Department's experience has been followed in the plans. This aid has also been the means not only of eliciting local subscriptions to a much greater extent than would otherwise have been the case, but in some instances of causing buildings to be undertaken which

without such aid would not have been begun at all. It may also be observed that the legal obligations entered into by any place receiving a building grant afford a security for the permanence of Schools of Art which might otherwise be abandoned at a period of temporary depression. Schools of Art have memorialised their lordships against adopting this recommendation. My Lords feel bound, however, to adopt the recommendation of the Select Committee that all direct grants should be withdrawn in future; and they will promote the erection of suitable buildings by enabling masters of Schools of Art and local architects to visit the training school and profit by all the experience the Department possesses. No grants will be made in aid of renting or repairing any established School of Art, which must pay all charges for rent, taxes, and repairs.

In accordance with the recommendations of the Select Committee, no further grants will be made to Schools of Art as such in aid of purchasing examples of a high artistic character, but aid towards obtaining a few elementary examples to be used in the artisan night classes will be continued. Considering the loose and inaccurate style of drawing still prevailing and almost popular, my Lords question the policy of this recommendation, but they propose at least to give it a trial. The local Schools of Art will be free to select and use what examples they please, except only in the few instances of some descriptions of works to be sent up for the national competition.

All local examinations in art, both in Schools of Art and elsewhere, where elementary drawing is taught, except in training colleges, will be conducted, in future, as in schools of science, by local authorities and not by Government inspectors. No more local medals will be given in future by the Department, and the number of prizes of books and instruments will be reduced in accordance with the recommendations of the Select Committee.

With respect to the recommendation of the Select Committee that "payments to certificated art teachers should be so far assimilated to those made to teachers of science that a capitation payment should be made for every artisan student who has received 40 lessons within the year," my Lords have to remark, in the first place, that no capitation payments are or ever have been made to teachers of science, who are paid wholly on results after having given 40 lessons during the year; and in the second place, that no evidence was submitted to the Select Committee on the policy of applying a capitation grant for the instruction of artisans. A capitation grant on behalf of a school child may be defended on the ground that the child is unable itself to pay for its instruction. In night art-classes as well as in a School of Art the artisan must pay a fee for his instruction or he cannot obtain it, and his attendance is his own voluntary act for his own direct and immediate benefit. If the capitation were sufficiently high the artisan might be tempted by the remission of all fees, and perhaps even by receiving a share in the capitation grant, to record forty attendances unaccompanied by serious study. Any capitation grant, however low, becomes a premium to the artisan to pay less than he otherwise would, and is in opposition to a sound system which would rather aim to encourage him to pay the full price within his means. The point always to be borne in mind is, that if local Schools of Art are to take a permanent footing in this country, the work can only be accomplished by inducing those who derive benefit from them to support them adequately. A capitation grant would violate this principle and be fatal to self-support and voluntary exertion. The cost of any capitation grant would be great and beyond control. It may be inferred from certain documents that the Art masters would wish it to be about £2 a head. It will be obvious that the amount of capitation grant ought to be fixed, if at all, not with reference to the existing number of Schools of Art, and the number of artisans attending them at the present time, but with reference to any possible extension of these numbers. The numbers of the industrial classes who might claim a capitation grant probably exceeds four millions. Although it is not likely that so large a number would be claimants for a capitation grant, still the numbers would probably be much too large to admit of any such amount of capitation grant as that suggested. A small capitation grant would not be worth all the trouble and the details of administration necessary. My Lords therefore arrive at the conclusion that they could not undertake the responsibility of recommending this mode of assistance to the consideration of Parliament. The proposed removal of the obligations to perform unremunerative work and of the restrictions as to examples, &c., places the art teachers in a better position than ordinary drawing masters. The art teachers are trained at the public cost, and are certificated as competent: they are relieved of the risk of finding suitable premises and costly examples; they may teach at any rate of fees, whilst pupils are attracted to them by Government examinations and prizes, National scholarships, and Free studentships. With advantages like these any direct payment from the State to the art master may be dispensed with. My Lords are clearly of opinion, that if any direct payments are to be made to Schools of Art at all, they must be of a character to be under strict control as to amount; that they must not create the expectation of vested rights, or prejudice the success of voluntary exertions, and that they must be capable of being easily modified and withdrawn as Parliament may desire.

My Lords consider that some direct payments may continue for the present to be made in respect of students trained locally as teachers, as national scholars, and as local prize students, and also in respect of making an annual report for the information of Parliament. Payments for affording elementary instruction to schoolmasters or pupil-teachers or to adults in night classes will be continued to Schools of Art if the Committee think fit to engage in this work.

As respects elementary instruction in drawing in schools for the poor, and in night classes for adults, my Lords do not consider that the objections against capitation payment in a School of Art apply to the children of the labouring poor in a national school. It is proposed to continue a low payment somewhat of the nature of a capitation payment on school children learning drawing, and to raise the present payment from 6d. to 1s. for each school child who passes an examination in elementary drawing. Graduated payments on results will continue in force. Aid in obtaining suitable examples of an elementary character will continue to be given as at present, as well as prizes to the children.

Payments and prizes for elementary instruction for pupil-teachers, schoolmasters, and adults taught in night classes will be continued, such payments being made only on results. Aid on elementary examples will continue to be given. And all teachers who have obtained the second grade certificate will be qualified to receive payments.

The local examinations in schools for the poor and night classes in Mechanics' Institutes and similar institutions will be conducted as in schools of Science by the local Committees, and not by inspectors, and the works will be sent up to the Department for examination. Elementary instruction in drawing will thus be put on a distinct basis of its own, and a separate vote will be proposed to Parliament for it. The managers of schools for the poor and of Mechanics' Institutes and other similar institutions will be able to take advantage of the government aid without having necessarily any connexion with a School of Art; but there will be no objection to any organization for such instruction and for examinations in connection with a School of Art, if the respective managers agree upon having them.

In future the Department will conduct all correspondence direct with the managers of Schools of Art, Mechanics' Institutes and other institutions, and schools for the labouring poor, and will make all payments to

them, and not to the masters as at present. The managers and the teachers will therefore be free to make their own arrangements for payment.

My Lords concur in the recommendations of the Select Committee that the National Art Training School should be maintained according to the evidence of all the witnesses, and propose that the national scholars chosen from local schools shall be increased in number.

In accordance with the recommendation by the Select Committee, there will be an annual national competition for prizes of books, instruments, and the like, among works produced both in night classes and in Schools of Art; and payments will be made to the managers of the schools or night classes from which the successful works have been sent. The national medallions will be discontinued, and a very few medals substituted for them. No School of Art will be obliged to send works to this competition; but if they elect to do so, they must in a part of the course follow certain prescribed examples, so as to subject the competition to an equal standard of judgment for the whole country. Artists will continue to be the judges of such works; but in cases where original designs for manufactures are sent, besides artists as judges, my Lords will consider the propriety of inviting the assistance of competent persons as representing the purchasers in the community.

My Lords will endeavour to render the collection of works of decorative art at South Kensington as useful as possible throughout the country, and with this object will revise the present regulations. They propose to relieve Schools of Art of all cost of transport, packing, and conducting the exhibitions, requiring only that suitable space be provided for the purpose by the locality at its own cost, and for a sufficient time to warrant the expense to the State.

The votes for the Museum at South Kensington, the Schools of Art, and for elementary instruction in drawing, will be kept distinct and laid before Parliament in greater detail than heretofore, and the cost of examples to be preserved in the Museum will be transferred to the estimate for the Museum.

Their Lordships think it right to observe that the cost of purchasing objects for the Museum is to be viewed not as an expenditure transferable to local Schools of Art, but is rather a national investment which has both an intrinsic value of its own, and one which even increases in value. This expenditure does not in any manner affect the amount of aid given to local Schools of Art which it is their Lordships' opinion should as far as possible have the character of voluntary and self-supporting institutions under local management, and always aim at that independence of State control which is so honourable a characteristic of the general feeling of this country.

The changes proposed will slightly diminish the total estimate for the Art Division of the Department in the present year, and if in the growth of the system any increase should take place in future years, it will probably be confined to the head of elementary instruction for the poor.

The schedule to the foregoing minute gives the payments on behalf of artisans and children of the labouring poor, proposed to be made by the Department in all cases to managers of schools and classes as follows:—

I.—To Schools of Art.

(*a.*) Five shillings for every artisan who pays fees for being taught in a night class held three times a week, and passes satisfactorily an annual examination in a given time, and a further sum of ten shillings for such artisan student if he submits for examination drawings executed by him during the previous year which are satisfactory.

(*b.*) Five pounds for free studentships will be allowed for every fifty artisans satisfactorily taught in night classes of Schools of Art.

(*c.*) Ten shillings for each artisan who submits for examination satisfactory works executed by him during the year, eligible for national competition, and a further sum of ten shillings on behalf of each artisan student from whose works any are selected for national competition.

(*d.*) Five pounds for a national scholar, being an artisan or designer, admitted to the National Art Training School.

(*e.*) Ten pounds for every certificate taken by an art-teacher trained in the local school.

(*f.*) Ten pounds for the annual report, provided that artisan night classes are held, a free studentship obtained, and works sent to the national competition.

(*g.*) See also II.

II.—To Night Classes in Mechanics' Institutes and similar Associations, and National Schools, &c.

(*a.*) Five shillings for every artisan who pays fees for being taught in a night class held three times a week, and passes satisfactorily an annual examination of the second grade in a given time, and a further sum of ten shillings on such artisan student if he submits for examination drawings executed by him during the previous year which are satisfactory.

(*b.*) Ten shillings for each artisan who submits for examination satisfactory works executed by him during the year, eligible for national competition, and a further sum of ten shillings on behalf of each artisan student from whose works any are selected for national competition.

(*c.*) The teaching in night classes may be given in connexion with Schools of Art or not. Teachers must have taken second or third grade certificates.

III.—To Schools for the Labouring Poor.

(*a.*) One shilling for every child in a national or similar school taught drawing satisfactorily, with additional payments of two or three shillings for success. Managers of schools for the labouring poor are free to have the teaching of drawing given either in connexion with a School of Art, or by any teacher certificated in the second grade.

Managers of schools for the labouring poor and of night classes for artisans will be aided to the extent of 50 per cent. on examples for elementary drawing.

The above-mentioned payments are exclusive of prizes to be awarded to students themselves.

THE PATENT LAWS.

The following are the recommendations of the commissioners appointed to inquire into the working of the law relating to letters patent for inventions:—

"1. Your commissioners do not find that the present cost of obtaining letters patent is excessive, or the method of payment inconvenient; they do not therefore recommend any alteration of the present system on those points; but they think that patent fees should not be made to contribute to the general expenditure of the state until every reasonable requirement of the Patent Office has been satisfied. 2. They are unable to recommend a preliminary investigation into the merits of the invention for which a patent is claimed; but they advise that a careful inquiry be instituted under the direction of the law officers of the Crown as to whether there has been any previous documentary publication of the invention, either by grant of letters patent or otherwise; and if such publication have taken place, that the patent shall be refused. No evidence other than such documentary evidence should be admissible, and the reasons for the refusal to grant the patent should be certified by the law officers; an appeal from their decision should lie to the Lord Chancellor. 3. Your commissioners are of opinion that the present mode of trying the validity of patents is not conducted in a satisfactory manner. That such trials ought to take place before a judge sitting with the aid of scientific assessors, but without a jury, unless at the desire of both parties to the suit or action. That such assessors ought to be selected by the judge in each case, and the remuneration to be paid them be

included in the costs of the suit and action, and provided for in such manner as the judge shall direct. That no special judge be appointed for the trial of patent cases, but the judges of law and equity be empowered to make rules by which one court should sit for trial of patent cases exclusively. That on such trial the judge, if sitting without a jury, decide questions of fact as well as of law. 4. That the granting of licences to use patented inventions ought not to be made compulsory. 5. That patents ought not to be granted to importers of foreign inventions. 6. That in no case ought the term for which a patent is granted to be extended beyond the original period of 14 years. 7. That in all patents hereafter to be granted a proviso shall be inserted to the effect that the Crown shall have the power to use any invention therein patented without previous licence or consent of the patentee, subject to payment of a sum to be fixed by the Treasury. 8. While, in the judgment of the commissioners, the changes above suggested will do something to mitigate the inconveniences now generally complained of by the public as incident to the working of the patent law, it is their opinion that these inconveniences cannot be wholly removed. They are, in their belief, inherent in the nature of a patent law, and must be considered as the price which the public consents to pay for the existence of such a law.

(Signed) "Stanley, Overstone, W. Erle, W. P. Wood, H. M. Cairns, H. Waddington, W. R. Grove, W. E. Forster, Wm. Fairbairn."

DUBLIN INTERNATIONAL EXHIBITION.

The allotments of space to exhibitors in the United Kingdom have been issued, but, owing to the space demanded being seven times in excess of the whole quantity at the disposal of the Executive Committee, it has been necessary to refuse many applicants and considerably reduce the demands of others. The Corporation of the City of London, the National Gallery, the Royal Academy, and numerous private individuals, lend pictures for exhibition. There will be a very fine display of furniture, most of the principal London makers exhibiting. Glass and china will also be well represented. Nottingham and other manufacturing towns will make a collective display. The British colonies will be creditably represented. Nova Scotia will have an admirable collection, the legislature having voted a large sum for the purpose. Canada and some of the other North American colonies will also be represented; and Natal and Mauritius intend to exhibit. The foreign contributions will be varied and attractive. The Emperor of the French has promised to send Sèvres china and other objects. Krupp, of Esson, will exhibit steel ordnance. A very fine collection of textiles is promised from Rhenish Prussia; lamps and bronzes from Stobwasser, of Berlin; pianos from Zurich, and other manufactures from Switzerland, as well as a good collection from Russia.

Fine Arts.

South Kensington Museum.—The Lords of the Committee of Council on Education have recently issued a minute, expressing their desire to obtain a design for the decoration of one of the large lunettes at the north end of the south court. The lunette is a semi-circle of eighteen feet radius, a strip of one foot six inches high being cut off the bottom by the skirting. The subject is to be an illustration (life-size) of workmanship in any decorative art or manufacture. Three artists will be invited to make suitable designs, for which the Department will pay £50 each. In addition to the artists to be named, artists of any country not specially invited can compete if they think fit to do so. Two sums of £50 and £25 will be paid respectively to the two artists, not named by the Department, whose designs are chosen. The design ultimately adopted by the Department will be enlarged by students for execution in mosaic, life size, and the artist whose design is chosen for execution will be required to superintend the enlargement of the work and approve it, for which he will receive a further payment of £50. All the designs will be publicly exhibited. They are to be made to a prescribed scale, namely, within a lunette formed by the segment of a circle of one foot radius, cut off by a chord parallel to the diameter one inch above the diameter. Thus the segment will be of nearly two feet base, eleven inches high. The designs are to be sent in with a cipher, on or before the 15th June, 1865, addressed to the Secretary of the Science and Art Department, South Kensington, London, W. The names of the judges will be hereafter announced.

Exhibition of Drawings on Stained Glass.—The valuable collection of drawings (above seven hundred), made by the late Mr. Charles Winston, will be exhibited next month, under the auspices of the Archæological Institute, in the rooms of the Arundel Society. These drawings were made with the most scrupulous attention to accuracy of detail, truth of colour, and form. Doubtless such an exhibition will be very acceptable just now, as so much attention is being given to an art nearly lost. Some of Mr. Winston's friends and admirers are preparing to collect and publish, as a memorial of him, the papers on painted glass, &c., which he had communicated at various times to different societies of which he was a member; many of these have never before been published. The volume will be richly illustrated by many coloured plates from his original drawings, as well as wood engravings, which have been intrusted to Mr. Philip Delamotte, of King's College. This work will be published by Mr. Murray.

Commerce.

The French Treaty and English Soda and Bleaching-powder.—The French Government have returned the following reply to representations which have been made to them, setting forth the injurious effect of the rate of duty leviable under the Anglo-French treaty, upon soda and bleaching-powder exported from this country into France:—"When in 1860 the import duties on the chemical productions in question were fixed at 13 per cent., and commencing from October the 1st, 1864, at 10 per cent. *ad valorem*, the French manufacturers felt considerable anxiety, which was subsequently justified by the great disparity between the cost of manufacture in England and in their own country; it was, indeed, only through the removal of the salt duty, and through strenuous exertions on their part, that they were enabled to sustain the competition of England. The difference between the price of coal in the two countries constitutes an advantage to the English manufacturers, 15 francs per ton on coal, or 60 francs per ton on soda ash, whilst the import duty is only 30 francs, or 41 francs, including the Excise duty. The cost of salt and of pyrites seems to be about the same in either country. But, apart from this, the documents published by the French Custom-house authorities show the exportation of sodas, not to mention 116 tons shipped to outports during the first three-quarters of this year, to have been unimportant, while, on the other hand, since the commencement of the present treaty, Great Britain has exported to France 3,190 tons of sulphate of soda, 1,983 tons of soda ash, and 2,586 tons of crystals of soda. Bleaching-powder, however, may possibly be in a better position to allow of an abatement in the import duty than soda-ash or crystals of soda, but it must be observed that in its manufacture, which is closely connected with that of soda, of which it utilises the principal residuary product, it is but reasonable to take into account the reductions on the last-named article. Besides, the importation of bleaching-powder, referred to by the petitioners, which

took place at the beginning of this year, was the result of an accidental state of affairs. At that period rags were exceedingly scarce, and large quantities of esparto grass and other similar materials were employed in England in the manufacture of paper, which considerably augmented the consumption of chemicals containing chlorine, and thus the price was raised to a point which permitted the French manufacturers to conclude some transactions, of a limited nature it is true, and which have entirely ceased since the month of August. Under these circumstances it has not been considered advisable to entertain the request of the Newcastle and Gateshead Chambers of Commerce."

Resin in France.—A new branch of industry is about to be commenced in the Morbihan, which it is expected will add considerably to the wealth of that province. The extraction of resin from the pine trees in the extensive forest of Lanvaux is to be carried on there on a grand scale. For that purpose several cargoes of earthenware cups have been imported at Vannes. The apparatus is extremely simple ; each cup resmbles a small flower-pot, with the differencc that one of the sides is concave, so that it can be fixed against the tree to be tapped, so as to acilitate the flow of the liquid when the tree is pierced.

American Hops.—Twenty-four years ago the United States produced only 6,000 bales of hops. Ten years later, in 1849, the production had increased to 17,000 bales. The next decade shows a larger increase than in any other agricultural product, the growth of 1859 reaching 55,000 bales. The crop of 1862 was estimated at 80,000 bales, a maximum which has not since been attained. The yield of 1863 was estimated at 65,000 bales, while that of 1864 is stated at 45,000 bales.

Patent Laws. — The following remarks, extracted from the judgment of the Lord Chancellor, in the case of Simpson *v.* Holliday, merit the attention of inventors:—" Cases of this nature frequently give rise to complaints of the state of the law. It is, therefore, right to point out how entirely the plaintiff's failure has arisen from not availing himself of the salutary provisions of the existing statutes. The provisional specification proves that a valuable discovery had been partially made, but not matured, and that the true conditions on which it might become an invention of practical utility had not been ascertained. Six months are allowed by the law for maturing the invention and accurately ascertaining and stating it; but in this case there does not appear to have been any attempt by the patentee to improve his knowledge; for the complete specification is a mere repetition of the provisional. Lastly, the inefficiency of the cold process, and the dangerous language of the specification must have been known long prior to this suit, and yet there was no attempt to remove the objection, as might easily have been done by a disclaimer under the statutes."

Marine Railway Round the Falls of Niagara.—At a recent meeting of the Detroit Board of Trade, the subject of a marine railway round Niagara Falls, for the transportation of vessels with their cargoes from Lake Erie to Lake Ontario, and *vice versa*, was brought up for consideration. The subject was suggested by a letter from Mr. Horace H. Day, who states that last summer he caused the proper surveys and plans to be made for a marine railway around the American side of Niagara Falls, adapted for transporting loaded vessels of all kinds of such tonnage as can be profitably employed in lake trade. This he proposes should be built as a substitute for a canal, and at a cost of about one-third. He asserts that it is practicable to pass vessels floating in the moveable locks from Lewiston to the Niagara River, above the falls, in less than two hours, with entire safety to ship and cargo, while the time of passing the necessary locks of a canal is estimated at from twelve to sixteen hours each way. This railway should (he says) have six rails of suitable construction, and with proper turn-outs, and different-sized locks for different-sized vessels. These locks are proposed to be wood and iron, with gates at each end.

Colonies.

New Zealand.—The coal obtained from Kawakawa mine, at the Bay of Islands, province of Auckland, is said to be of a first-rate character. To raise steam by means of the best coal from Newcastle the period of 1 hour and 45 minutes is required, while it has been found that for Kawakawa coal no more than 1 hour and 5 minutes is requisite. The province now possesses coal mines in various parts of the country.—The Auckland Gas Works are in a forward state. A capacious tank, for receiving the gas holder, is nearly completed; the diameter of the tank is 54 feet, the depth being 16 feet. A well, calculated to yield between 4,000 and 5,000 gallons in the 24 hours, has been sunk, after some considerable difficulty, experienced through the fact of the penetration being entirely through rock, to a depth of upwards of 200 feet. It has not been drilled in the usual manner with a screw, but with a jumper, which has been attached in lengths of wrought iron tubing, the same as a boring rod. The rock through which this well has been sunk consists of alternate strata of slate and freestone.—The bridge over the Waikonaiti stream is completed. It is of wood, and is about 400 feet in length, and 20 feet wide. The opening of the bridge is hailed by the inhabitants of the district as a great boon, many of them having suffered serious inconvenience from the impediments which previously existed to travelling.

Cotton and Sugar in Queensland.—Notwithstanding the unfavourable circumstances which operated against the raising of cotton during last year, the crop bids fair to exceed that of all previous seasons, and it was expected that upwards of one hundred bales would be shipped. Three gins, driven by steam power, have been constantly at work. A portion of the cotton was grown on the plantation of the Manchester Cotton Company; another portion at Nerang Creek, by a private company, and the remainder is the produce of various farms in the neighbourhood of Brisbane and Ipswich. That from the plantation of the Manchester Cotton Company is of fine quality, and although portions of it have been somewhat stained and injured by wet and unfavourable weather, it is considered to be worth 5s. 6d. per lb. in the present state of the market. In addition to the above, there are ten bales of ginned cotton, from the plantation of the Cabulture Cotton Company. These facts speak for themselves. That such satisfactory results have been attained during the unfavourable circumstances of the past season, show that cotton can be grown there with every prospect of success. Messrs. Board and Sons have produced some very fine sugar-cane, and a sample of sugar manufactured by Mr. Buhot, prize essayist on sugar culture, at Maryborough, from canes grown by Mr. Eaton there, promises to be good, dry, and of a rich yellow description—worth there about £40 per ton. The means of manufacture were of an exceedingly simple and rough kind—an old patent mangle being the crusher, and a saucepan the boiler.

Obituary.

The Duke of Northumberland died at Alnwick Castle on Sunday, the 12th instant. He was the youngest son of Hugh, the second duke, and was born in 1792. He married, in 1842, Lady Eleanor, eldest daughter of the Marquis of Westminster. In early life he entered the navy, and obtained the rank of post-captain in 1815. He saw, during ten years, considerable active service in the Mediterranean, but after obtaining his rank as captain he retired. In 1816 he was created a peer by the title of Baron Prudhoe, and sat in the House of Lords as such until he succeeded his brother, the third duke, in February, 1847. After leaving the navy, he devoted himself to travel, and with his friend Sir Gardner Wilkinson,

passed some years in Egypt and the Holy Land. In 1852, on the Earl of Derby being called upon to form an administration, he accepted the office of First Lord of the Admiralty. He was president of the Royal Institution of Great Britain, and of various other societies. Within the last few years he expended above £500,000 in improving the dwellings of the labourers on his estates. He was elected a member of the Society of Arts in 1814.

SIR JOHN HARE, F.G.S., F.S.A., a well-known citizen of Bristol, died recently at his French residence of Chateau d'Hardelôt, near Boulogne. He was born in 1784, and was the head of the firm of John Hare and Co., floorcloth manufacturers. He was chiefly notable for his connexion with the anti-slavery movement. In the heat of the discussions on this subject there was an election for Bristol, the candidates being Mr. James Evan Baillie, a whig, who supported the West Indian interest, and Mr. Edward Protheroe, a whig, who supported emancipation. Sir John Hare took an active part on behalf of Mr. Protheroe, and barely escaped with his life at one of the party banquets at Bristol, the Baillieites making a dead set at the Protheroeites. Sir John was knighted in 1840, on the presentation of a congratulatory address from the city of Bristol on her Majesty's marriage. He was the owner of the ship *Cambria*, which is said to have saved the crew and the passengers (including the 31st Regiment) when the *Kent*, East Indiaman, was destroyed by fire in the Bay of Biscay. He was elected a member of the Society of Arts in 1861.

JOSEPH LIES, a Belgian painter, died recently of consumption, at the age of forty-three years. On the very day of his decease he finished a picture which he had in hand. Lies was of a truly artistic nature, learned, gentle, and sympathetic, and was endowed with great intelligence and a kind heart. He was much esteemed by the elder painter Leys, to whose instruction and influence he was much indebted in the earlier portion of his career. A portrait of one of Ley's children by Lies is considered the best work of this artist.

Notes.

BRITISH HOROLOGICAL INSTITUTE.—A lecture on "The Greenwich System of Time Signals," illustrated with diagrams, by William Ellis, Esq., F.R.A.S., of the Royal Observatory, Greenwich, is to be delivered at the house of the Society of Arts, on Friday, 24th February, at 8.30 p.m., the Right Hon. the Lord Mayor in the chair. Free admission to members of the Society of Arts.

WEST LONDON EXHIBITION.—A public meeting was held in the St. John's school-rooms, John-street, Tottenham-court-road, on Wednesday, the 8th inst., for the purpose of affording information respecting the industrial exhibition which has been set on foot in the western district of the metropolis, and adopting measures in furtherance of it. Deputy-Judge Payne occupied the chair, and was supported by Mr. J. A. Nicholay, Mr. T. H. Filmer, Messrs. G. Corbett and D. P. Foxwell, and a deputation from the Central Committee. The industrial exhibition movement in the west of London originated with the committee of the All Souls Working Men's Club. Ten members of the Working Men's Club Exhibitors' Committee, and an equal number elected from a public meeting, were soon constituted a central committee, whilst to secure an efficient representation of the surrounding districts, numerous public meetings have since been held, at which district committees have been formed, each of which appoints a delegate, who, with its chairman and secretary, become members of the central committee. With the view of obtaining a suitable building, it was determined to rent the site of the late Portman Barracks, until the end of June, for a sum of £500. Upon this it is proposed to erect a building, which will give ample accommodation. It is proposed to open the exhibition from the middle of April to the end of June. The committee calculate that to accomplish these objects they will require a guarantee fund of £2,000, over £1,200 of which has already been guaranteed.

EXHIBITIONS.—The Lucknow Exhibition was opened on the 24th December. All the capital for the great exhibition in Bombay has been subscribed, and all the shares have been taken up. The *Gazette* says:—"One great difficulty connected with the undertaking is occasioned by the want of available house-room in Bombay. The city is likely to get a name for very cold hospitality, if, after inviting ten thousand strangers to visit the exhibition, it denies them the ordinary accommodation of board and lodging. Yet there is certainly no place of shelter for a multitude of visitors in a city in which European residents often have to search vainly for weeks together for houses (or rather barns) in which to rest their heads. The projectors of the exhibition must therefore provide an hotel for their expected guests; and we hear that, as the time is too short for masonry work, it is their intention to have a large iron and terra-cotta building erected near the exhibition."

WHAT IS AN INCH OF RAIN?—The last weekly return of the Registrar-General gives the following interesting information in respect to rainfall:—"Rain fell in London to the amount of 0·43 inches, which is equivalent to 43 tons of rain per acre. The rainfall during last week varied from 30 tons per acre in Edinburgh to 215 tons per acre in Glasgow. An English acre consists of 6,272,640 square inches; and an inch deep of rain on an acre yields 6,272,640 cubic inches of water, which at 277·274 cubic inches to the gallon makes 22,622·5 gallons; and, as a gallon of distilled water weighs 10lb., the rainfall on an acre is 226,225lb. avoirdupois; but 2,240lb. are a ton, and consequently an inch deep of rain weighs 100·993 tons, or nearly 101 tons per acre. For every 100th of an inch a ton of water falls per acre." If any agriculturist were to try the experiment of distributing artificially that which nature so bountifully supplies, he would soon feel inclined to "rest and be thankful."

MEETINGS FOR THE ENSUING WEEK.

MON. ...Society of Arts, 8. Cantor Lectures. Professor Ansted F.R.S., "On the Applications of Geology to the Arts and Manufactures." (Lecture III.)
British Architects, 8.
Medical, 8.
R. United Service Inst., 8½. Commander P. H. Colomb, R.N., "On Modern Naval Tactics."

TUES....Civil Engineers, 8. Discussion upon Mr. England's Paper on "Giffard's Injector."
Statistical, 8. 1. Dr. Wm. Farr, "On Infant Mortality, and on alleged Inaccuracies of the Census." 2. Dr. Hyde Clarke, "On the supposed Decrease of the Turks."
Pathological, 8.
Ethnological, 8. 1. Mr. John Crawfurd, "On the History of Cannibalism in reference to Social Progress." 2. Mr. Travers, "On the Destruction of the Aborigines of Chatham Island by a Maori Invasion."
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."

WED. ...Society of Arts, 8. Mr. George R. Burnell, F.G.S., "On the Municipal Organisation of Paris, especially with reference to Public Works."
Geological, 8. 1. Prof. R. Harkness, "On the Lower Silurian Rocks of the South-East of Cumberland, and the North-East of Westmoreland." 2. Mr. R. Spruce, "Note on the Volcanic Tufa of Latacunga, at the foot of Cotopaxi." Communicated by Sir R. Murchison. 3. Dr. H. P. Blackmore, "On a Discovery of Flint Implements in the Drift at Milford Hill, Salisbury." Communicated by Mr. John Evans.
Archæological Assoc., 8½.

THURS...Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."
Antiquaries, 8.
Royal, 8½.
Philosophical Club, 6.

FRI.......Royal United Service Institution, 3. Capt. H. Schaw, R.E., "The Employment of Electricity in Military Operations."
Royal Inst., 8. Mr. John Evans, "On the Forgery of Antiquities."

SAT.......R. Botanic, 3¾.
Royal Inst., 3. (No Lecture.)

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

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1999. A. V. Newton.	2039. C. F. Darcagne.
2021. J. B. Buffoni.	2044. W. Dalziel.
2029. S. Moore.	2048. T. Wilson.
2031. R. A. Brooman.	2051. L. Yvose-Laurent.
2032. S. and C. Collins.	3091. J. Barnsley.
2037. W. Dove.	

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2050. J. J. Parkes.	2130. W. Clark.
2057. E. H. Waldenstrom.	2135. W. Bullough.
2063. J. Thomsen.	2150. T. Fowler.
2072. F. Taylor.	2196. A. V. Newton.
2073. J. Allan.	2702. I. Schwartz.
2074. B. W. Barwick and W. Hartley.	2784. J. Thompson.
2079. J. E. Grisdale.	3146. Sir J. Gray.

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311. A. C. Bamlett.	384. T. Davison.
324. P. Shaw.	395. W. G. Valentin.
325. H. A. Silver.	408. C. Turner and J. Shaw.
328. W. Clark.	443. W. Hinton.
657. E. G. Camp.	737. W. Barber.
370. R. A. Brooman.	376. J. S. Joseph.
691. M. Henry.	390. E. E. Allen and J. Stewart.
354. W. Macnab.	392. E. Green and J. Newman.
359. R. Johnson.	

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246. E. Stevens.	

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AND OF

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111TH SESSION.] FRIDAY, FEBRUARY 24, 1865. [No. 640. VOL. XIII.

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Wednesday Evenings at 8 o'clock.

MARCH 1.—" On the Means employed in taking Fish, especially with reference to Submarine Illumination." By F. W. CAMPIN, Esq.

MARCH 8.—" On Cotton Gins." By ZERAH COLBURN, Esq.

CANTOR LECTURES.

The Second Course of Cantor Lectures, the subject being " The Applications of Geology to the Arts and Manufactures," by Professor D. T. ANSTED, M.A., F.R.S., is now being delivered on Monday evenings, at Eight o'clock, as follows:—

FEB. 27TH.—LECTURE 4.—On Mineral Materials (*continued*): Building Stones and Slates, and their Relative Value under given Circumstances of Exposure, and on Methods of Quarrying.

MARCH 6TH.—LECTURE 5.—On Stratified Deposits of Minerals as Coal and Iron Ore, usually obtained by Mining Operations, and on Mining Methods for such Deposits.

MARCH 13TH.—LECTURE 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture.

INSTITUTION.

The following Institution has been received into Union since the last announcement:—

Huddersfield Mechanics' Institution.

Proceedings of the Society.

CANTOR LECTURES.

SECOND COURSE.—THIRD LECTURE.—MONDAY, FEB. 20.

MINERALS OBTAINED FROM SUPERFICIAL DEPOSITS.

Professor ANSTED stated that he next proposed to speak of mineral substances used for special practical purposes. Of these there are several classes:—(1.) Sands used in manufacture, or for casting. (2.) Sands and gravels consisting partly of gold, diamonds, tin ore, &c. (3.) Plastic clays. (4.) Limestones used in construction after burning. (5.) Building stones. (6.) Coal, iron stone, etc., forming strata in the earth. (7.) Ores in mineral veins. In his address this evening he meant to allude to the first four of these classes. *Silica sand* is valuable in glass making. Samples free from foreign substances are obtained from rocks of various geological ages; among others, from the beds at the bottom of the tertiary series at Alum bay, Isle of Wight, where the quality is very good, and adapted for the best flint glass. Others are from the Hastings sands; from the lower greensand at Aylesbury; from the sands of Reigate, and from near Falmouth harbour and other places on the coast of Cornwall. A peculiar kind of sand is obtained not far from Bath, and is known as Bath stone. It is used for polishing. It consists chiefly of the cases of infusorial animalcules accumulated in beds, and consisting of almost pure silica in a fine state of division. Tripoli, or rotten stone, is somewhat similar, and is obtained from limestone of the carboniferous series. The polishing powder of Bilin, near Berlin, is of the same nature, and has the same origin. Sands and gravels often contain fragments of such metals and minerals as can be broken or ground up into minute particles, and are not readily decomposed by weathering. These include diamonds, amber, iron ore, tin ore, and gold. Some are rare, others common. Some occupy a small space in the sand or gravel that contains them, but others form the principal part of such material. Diamond washings are carried on in India and Brazil. The process of exploring is simple enough; the implement being a pick-axe, with which men dig into every promising spot. The diamond matrix is first picked out from the loose pebbles, and the selected mass spread out on a flat surface, where it can be examined grain by grain. The earth sought for is a red ochrey clay, containing oxide of iron; but diamonds are also found in the loose mud. Alluvial ores may be included in one general description. Gold, and the oxides of tin and iron, are found in important quantities, and the treatment of tin ore and gold requires separate notice. Stream tin occurs in Cornwall, but the chief supply is from the Island of Banca, in the Eastern Archipelago. Gold is chiefly obtained from sands and gravels derived from some parent rock or vein, but detached, and rarely affording a clue to its origin. Such sands are found in Europe, in certain parts of Siberia, in Africa, especially on the west coast, in Brazil, Mexico, California, Colombia, Australia, and New Zealand. Gold is found in river beds, and

in ancient detritus. The banks of the Rhine and Danube, and the sands of the Tagus are auriferous. The washing of gold alluvia is a very simple matter. A wooden bowl, shaken artificially with water, separates the heavier from the lighter mud. The latter is floated off until a residuum of gold is obtained. Each country and river bed has its own indications. In some the gold is found in dust, or spangles floated away by water. In others the particles are grains, and resist the current. Sometimes heavier grains or nuggets are found; native platinum and rare metals often occur with them. These deposits may be brought down from great distances, where the gold-bearing veins crop out. More usually the auriferous mud is but the washing of auriferous sands and gravels long since accumulated. Thus, in the Rhine, the mud is derived from a sand bank above the place of working. The gold is found in flakes or spangles so exceedingly minute and thin that it needs fourteen hundred to weigh a single grain. A cubic yard of the mud will contain from five to forty thousand of these spangles. Compared with Siberia and South America, these Rhine sands are very poor, the Siberian gravels yielding five times, and those of Chili ten times as much. The Siberian gravels are coarse, being composed of shingle of fragments of the adjacent rock. They occur along the eastern flank of the Ural chain, both in the north and south valleys, and in those which run transversely. The former are generally the richer. The gold alluvia of Siberia are of definite geological age, and belong to the boulder gravels deposited by ice during the glacial period. The Brazil auriferous deposit is called *Cascalho*. It is an indurated soil broken up with pickaxes, and afterwards exposed to a current of water, or a loose gravelly stratum of rounded pebbles. It rests on granite, and is covered by earthy matter. Its thickness is very variable. The Californian gravels consist of coarse and small stones, mixed with mud and fine sands. Some of these are the actual beds of the existing streams; but the great deposits of such material have been already made, and are not now in progress. In Australia the gold-bearing gravels are deep, and seem to carry gold throughout. Shafts sunk through them to a couple of hundred yards reach gold, and the heaviest and largest lumps of gold have been found at the lowest depths. The most important recent discoveries of rich gold alluvia are those of British Columbia, New Zealand, and Nova Scotia. In all these gold has been found by prospecting, the first discovery being accidental. In the rivers or gullies opening out from the mountains, there are sands and gravels containing the gold in minute specks, visible grains, and now and then great nuggets. These latter are the temptation to the adventurous miner, and, at rare intervals, several of unusual size are found in the same locality. As a specimen was mentioned a case in the gravels of British Columbia. Five partners commenced working at Cariboo, in 1861. During the first three days they obtained little. On the fourth day they raised 4 ozs.; on the fifth day, 10 ozs.; and on the sixth, 41 ozs. of gold. The yield went on increasing until it reached 387 ozs. in one day, and the last day's work resulted in the obtaining of 469 ozs. The total value of the gold raised was upwards of £20,000, and the dimensions of the claim were only 80 feet by 25 feet superficial. The economical working of auriferous deposits is a matter of practical importance. The methods adopted are nearly the same as those in use in Cornwall for reducing tin ore. The cost of crushing gold quartz would, no doubt, be somewhat greater than in Cornwall, but the operation may be profitable, even when the percentage of the precious metal is extremely small, provided the quantity of ore is sufficiently large. Gold gravels sometimes contain the following crystals and native metals:—Sapphire, topaz, spinel-ruby, zircon, tourmaline, garnets, olivine, platinum, palladium, osmium, stream tin, diamonds, and quartz. All the productive streams for tin ore are in the valleys on the southern side of the Cornish peninsula, although most of the richest veins of such ore are on the northern side. Here we have evidence of a drift from the north conveying the tin; and a similar conclusion must be drawn from the facts concerning the principal gold drifts north of a certain line in Europe and Asia. But how is it that such a drift, produced by a submarine current or wave flooding the land, can have deposited the stream ores? This involves a consideration of the mode in which the granite districts of Cornwall have been decomposed. Those who know the infinite multitude of small veins and branches carrying tin ore that traverse the easily decomposed granites of St. Austell and its neighbourhood, will not doubt that if a body of water were now to rush across that part of our island, the decomposed granite would be removed, the broken up quartzy strings containing tin would be rolled into pebbles, and the tin-bearing pebbles would be separated. Owing to their greater specific weight these pebbles would first come to rest, and if once drifted into hollows would not easily be removed. On the other hand, the lighter material would be much further transported. It is difficult to form an idea of the original extent of the accumulations of tin stone gravels that have been the object of incessant exploration for several thousand years in Cornwall. There are perpetual indications of former workings, at intervals, along the whole distance from Dartmoor to the Land's End, and the ground has often been turned over twice or thrice. But there is still sufficient unmoved ground to illustrate the general geological facts. The stream works mark great changes in level as well as causes of drift, now unknown in the district. The upper limit of the tin ground in Pentuan was 48 feet below the level of high water at spring tides and 30 feet below the level of low water, but it was once covered with vegetable soil, and the land at that time possessed human inhabitants. In many other instances, as well as *this*, there is unmistakable evidence of depression, to the extent of at least fifty feet within the human period, without the smallest evidence of any great earthquake disturbance or any change in the dip of the rocks. It is also certain that the depression has been general over an extensive area, and that it has been very gradual. On the other hand, there is equally good evidence in Cornwall itself and in the adjacent county of Devon, that in many places there has been local elevation, to an extent even much greater than this depression, and also within the human period. It must be remembered that, while sometimes the valuable minerals, being heavy, are left behind and deposited at the bottom; in others they are lighter than other stones, floated onwards, and caught up accidentally, or left permanently at the top. This is the case with amber—the ancient resinous excretion of certain extinct pines. On the shores of the Baltic, pits are occasionally sunk through loose sand to a hundred feet, with a view of reaching the fragments of this substance in the uppermost of the regular strata below the sand. Elsewhere the amber is floated or drifted to shore during storms, and is then picked up before it is caught and covered up by the blown sands. The lecturer then proceeded to the consideration of plastic materials. Four varieties of clay are used in the arts, each having its own peculiar properties, and each available for some special purpose. They are brick clay, fire clay, pipe clay, and pottery or porcelain clay. Brick clays are widely spread, and few countries are without some varieties. In England they are common, often forming very thick and extensive beds. The clays of any locality are almost always used for brick-making for common purposes in the district where they occur; for clay will not readily bear the cost of conveyance. The finer kinds are different, being conveyed in a prepared state to the place of manufacture. Brick clays consist of a coarse and irregular admixture of pure clay—with sand, lime, iron, carbon, mineral alkalis, and a host of impurities. The admixture with sand is essential; and the proportion of sand in clay, as well as the composition of clay, admit of great variety. The

clay must be free from large stones; but the admixture of a large percentage of silica-sand is not incompatible with the formation of an excellent brick. The number of stock bricks annually manufactured and used in England must exceed one thousand million; and brick-pits have been opened in the neighbourhood of every town in which dressed stone is more expensive than brick. Generally, iron, lime, potash, or soda are unfavourable signs in a brick clay; for they would cause the brick to run in the furnace. By burning clay loses the capacity of mixing with water, and its plasticity. It becomes hard, resists weathering; and if iron has been present, it converts the dull brown of the clay into a bright red. To make a good brick, the clay must be freed from pebbles and ground up into a uniform mass. In preparing for manufacture, it must be mixed with coarse sharp sand. In a good brick clay there should not be more than 2 per cent. of lime or potash. Fire-clay is a variety that bears intense heat without melting; and fire-bricks should bear exposure in the interior of furnaces. The alkalies, alkaline earths, and iron-oxide, which would help to flux it, are absent. Fire-clays often contain carbon, and some are the floors beneath seams of coal. Of other clays some are adapted for coarse pottery; others for finer kinds of ware; others for the whitest and best kinds. There are also pipe clays, and, lastly, *Ka-o-lin*, found not only in China but in Cornwall and West Devon, in Central France, and in Northern Germany. Pottery clays are more plastic than brick clays, and resist the most intense heat of the furnace. They contract with much irregularity, and the iron they contain communicates a colour, varying in intensity with the quantity of the metal. Pottery clay is used for some manufactures little superior to ordinary brick or tile, and others hardly inferior to porcelain. No precise line can be drawn concerning them, nor does analysis strictly define their value. The raw material results from a separation of coarse and impure parts of common clay by water and exposure to weather. Pipe clay is a variety containing an excess of silica and very little iron. China clay is formed by a natural or artificial washing from the decomposed felspar of certain kinds of granite. It is of a loose earthy texture, and light (s.g. 2·21 to 2·26). The composition varies from different localities, the limits being wide. The preparatien of china clay for the potteries is simple, and consists in washing the decomposed rock in a succession of tanks, so that the particles of quartz, mica, and other minerals, may either fall from the water in which they were mechanically suspended, or be carried forwards by the velocity of the stream; while the fine particles, consisting of the remains of the decomposed felspar are allowed to settle quietly in tanks prepared for them. The decomposition of the granite leaves the quartz in stones, which are generally crystalline and angular. These are got rid of in a catch-pit, through which the whole is carried along by a current of water. The operation of washing has been performed naturally, both in Cornwall and Devonshire. The decomposed granite has been washed through a valley, the coarse particles of quartz being left in the upper part of the valley, and the particles of fine sand brought to the lower part. More than 10,000 tons of the finer and three times as much of the commoner kinds of clay are annually made use of in the Staffordshire potteries. Cements and plasters were next noticed. Their use is very ancient. They are of various kinds, and available under very different circumstances. The most common and familiar is *mortar*. It is obtained by calcining limestone, and converting it into quicklime. After calcining quicklime is a greyish substance, which absorbs water with the evolution of much heat, and falls into a fine powder, which is next mixed with two or three times its own weight of sharp sand to form mortar. In time a film of silicate of lime is formed round each grain of sand, and the whole mass, and the stones between which it is placed, become closely adhered. As there are different kinds of limestone, there result limes of different quality and properties. These require special treatment. Marbles or chalk make a rich lime, setting firmly only in dry air, while the very impure limestones with which clay is largely mixed, result in hydraulic limes, which set more or less rapidly in moist air, or even under water. Some impure limestones ars used in the manufacture of cements. Sometimes, by the admixture of certain substances (as puzzuolana) with rich limes instead of sand, hydraulic limes are produced. It is not difficult to trace the changes that take place in the conversion of limestones into cement. A layer of mortar, not too thick, placed between bricks or stone and kept in dry air, dries gradually, and holds stones together with extraordinary tenacity. But this is a work of years, and sometimes even centuries must run out before the extreme of hardness is attained. It is not unusual to find imperfectly-hardened mortar in very old constructions. Limestone is widely distributed, and almost every variety can be burnt for lime. In the manufacture of good common mortar pure limestones and all of fair ordinary quality are available; but in using them attention must be given to their composition, and even texture. The hardest make the fattest lime, other things being the same; but each variety yields lime of different quality—distinct in colour, in weight, and in the greediness with which it absorbs water. The mode of calcination varies, but after burning limestones, the quicklime is lighter than the ordinary stone, and differs from it essentially. Limestones that contain from one to six per cent. of foreign substances, such as silica, alumina, magnesia, iron, &c., yield rich limes. Poor limes are obtained from limestones in which foreign substances, such as sand, carbonate of magnesia, oxides of iron, and manganese, are present to the extent of from 15 to 30 per cent. These increase little in bulk on slacking, do not set under water, and are soluble, like the rich limes, except that they leave an earthy residuum. Between eminently rich and eminently poor limes there is, of course, every gradation, and great importance is attributed to the state of the limestones and the nature of the foreign substances present. Fossiliferous limestones make bad mortar, as the slacking is irregular. Limestones containing much silica swell in setting, and dislocate masonry executed with them. Where alumina is in excess the lime is apt to shrink and crack. Where carbonate of magnesia is combined with carbonate of lime, as in the magnesian limestones, the original bulk is well retained. Hydraulic limes are of very great value in construction. They are either obtained naturally from the burning of certain varieties of calcareous rock, or are manufactured artificially by mixing limestones with foreign ingredients, or by combining quicklime with foreign materials. Roman cement, Portland cement, Parker's cement, and many others, are varieties of artificial cement. Nodules and argillaceous bands in clay deposits yield the largest quantity and best quality of limestones for burning into hydraulic lime. The limestone is argillaceous and combined with other impurities, among which iron oxide and carbon are very frequent. It is generally considered that from 15 to 25 per cent. of a limestone should consist of silicate of alumina, in order that it may burn into a good hydraulic lime. Such limestone is got from the *septaria* or calcareous nodules, in the London clay at Sheppey, the Kimmeridge clay at Weymouth, the Oxford clay, &c. Similar material occurs in bands in the lias at Whitby, and elsewhere. Good hydraulic cement is made by mixing the river mud of calcareous and clayey districts with chalk. Admixtures of burnt clay as well as pozzuolano and trass, have also been found to render fat limes hydraulic. Portland cement, largely manufactured at the mouth of the Thames, is a mixture of chalk and river mud. Roman cement is formed of the nodules found near Harwich. In making cements the materials are pounded together under water, and afterwards dried and burnt. The cement is largely used for artificial stone, made up with broken and crushed brick, mixed with about ten or twelve times its weight of broken stones and pebbles. Portland

and Roman cements make an excellent concrete. Portland is in this respect stronger than the older manufactured Roman cement, but for many purposes there is nothing to choose between them. Gypsum (sulphate of lime) is collected and burnt, like common limestone, to manufacture a plaster or cement. The calcining of gypsum does not involve decomposition, but the water of solidification being driven off, there is left only a soft white powder called plaster of Paris; when this is united with water the water is reabsorbed, and the mass becomes first plastic and then solid. When mixed with weak glue instead of water, plaster of Paris becomes converted into *stucco*, a material also very largely used. When thrown into a vessel containing a saturated solution of alum, borax, or sulphate of potash, rebaked, once more powdered, and then moistened with a solution of alum, a hard plaster is obtained that takes a high polish. This plaster is called Keene's cement if made with alum, Parian with borax, and Martin's with pearlash. *Pozzuolano* is a volcanic earth of a reddish colour, originally found in the vicinity of Pozzuoli, not far from Naples. Similar material has since been obtained from extinct volcanic districts, especially in central France, near Andernach, on the Rhine, and even near Edinburgh. When used instead of sand in mixing with limes, these minerals render all limes hydraulic, and have been used in this way from time immemorial with great success. Coal-cinders and slags also hasten the absorption of the moisture, and facilitate the setting of the limes with which they are used. Artificial pozzuolanos are sometimes manufactured. Besides cements and terra cottas, used as artificial stones, many methods of imitating stone have been adopted. One of these, introduced some years ago by Mr. Frederic Ransome, deserves notice. It consisted of sand moulded with fluid silicate of soda, obtained by exposing flints in a steam boiler to the action of caustic alkali, at high temperature. At first Mr. Ransome supposed that by mixing sand and stone with the fluid silicate into a paste and exposing them to the air they would become solid. But stones thus made soon disintegrated. He then subjected them to the action of heat in a kiln, and found that at a bright red heat the silicate became an insoluble glass, unaffected by exposure to the air, and not cracking on exposure to frost. Stone thus made might be so porous as to filter, or so compact as to yield a material equal to Craigleith stone. Rubs and whetstones, garden vases, balusters, and various architectural features often constructed of terra cotta were thus produced, of superior quality and great durability. The stone thus made was found to become unsightly, owing to an efflorescence of sulphate of soda, and it was difficult to avoid disagreeable markings. The moulding of Ransome's artificial stone is easy and perfect, the shrinkage in the kiln extremely small. When finished it can be cut with the chisel. Its power of resistance to transverse strains exceeds that of excellent sandstones used for building, and is three times as great as the best limestones. To crushing weights its resistance is also remarkable. A two-inch cube sustained twenty-one tons. Ransome's "patent siliceous stone" was, however, too expensive to come into use on a large scale; and the ingenious inventor found a much cheaper and more satisfactory result by making stones and sand into a paste with the fluid silicate in the usual way, and then fixing the form instantaneously by dipping it into a solution of chloride of calcium, and producing a hard stone without drying or burning. It is difficult to form an idea of the rapidity of the process and the perfect result without seeing the experiment tried. The term concrete is generally applied to a species of rough masonry, consisting of gravel or broken stone mixed with lime, the lime being slacked upon, and in immediate contact with the gravel. The main uses of concretes are to distribute the weight of heavy constructions, and for backing coursed masonry where the walls are required to be of great thickness. Good concretes should set rapidly and completely, for to have any value all work in which this material is used, needs to be performed quickly; and therefore either hydraulic limes or mixtures are necessary. The former should always be used when they can be obtained. But though hydraulic lime is desirable, the quantity used should not be in excess. Some care in selecting the rough stones and caution in not making the concrete till the lime is already converted into mortar are essential. The rapidity of setting may be varied by admixture of different material. Artificial blocks of concrete are made. They require to be constructed with great care, of the best materials, and carefully rammed. If dried too rapidly they are apt to crack. The blocks are admirable when successful, but mischievous if carelessly constructed. Bituminous cements are used for street pavements to replace large flags. In our own country, where we have abundant supplies of natural flagstones, they are little thought of. In France they are extensively adopted. The materials for these pavements are of two kinds—one nearly pure, the other a natural mixture of bitumen and sand or carbonate of lime. Asphalte is the technical name for the bitumens commonly obtained for pavements, and they are abundant in France, at Seyssel, and elsewhere. The best asphalte is black, brilliant, and hard at ordinary temperature. It softens in the sun. It should be free from sulphate of iron, and from sulphur in any form. When used it requires to be mixed with mineral pitch in a boiling state, and then formed into a cement, a little quicklime being added while the bitumen is boiling. There are many other applications and contrivances requiring geological knowledge to make use of them to the greatest advantage, and a vast variety of cases in which some acquaintance with the nature, history, and origin of rocks, and some idea of their metamorphoses and of their associations, will greatly help the practical man to obtain the material he desires.

Twelfth Ordinary Meeting.

Wednesday, February 22nd, 1865; William Hawes, Esq., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Giles, Francis, 42, Blomfield-road, Maida-hill, W.
Phillips, Thomas H., 10, College-crescent, Finchley-road, N.W.
Savile, Edward B., 30, St. George's-road, Pimlico, S.W.
Spriggs, William, 10, York-row, Kennington-road, S.
Templetown, Major-General Viscount, C.B., Government House, Devonport.
Walker, Micajah Hilditch, 13, St. Swithin's-lane, E.C.
Warden, J. William, Warwick Cottage, Park-village East, N.W.
Yardley, Vincent, 3, Thorney-street, Bloomsbury, W.C.

The following candidates were balloted for and duly elected members of the Society:—

Edwards, Henry, 53, Berkeley-square, W.
Lambert, Charles, 3, Queen-street-place, E.C.
Runtz, John, Burlington-house, Stoke Newington, N.
Sandars, Samuel, 22, Sussex-gardens, Hyde-park, W.

The Paper read was—

ON THE MUNICIPAL ORGANISATION OF PARIS, PARTICULARLY WITH REGARD TO THE PUBLIC WORKS.

By George R. Burnell, Esq., F.G.S.

It seems that, at the present day, the results that have been obtained by the organisation of the service of public works in the neighbouring capital, have dazzled the public to such an extent that it would not be surprising were an attempt made to introduce some imitation of that system into our own country. Paris has been transformed with almost fairy-like rapidity; it has been improved in its hygienic and its general character; it has

become essentially the city of pleasure, and the abode of the man of intellect; public buildings of a fine monumental character have arisen on every side; and at the same time the service of the city, in so far as regards the daily wants of life, has been largely and well cared for. Railway stations have been opened, markets laid out, mairies, public schools, churches, hospitals built; and even theatres and places of public amusement have been founded with a degree of luxury of which we in England have no conception. The results that have hitherto attended the Imperial Government of France have, indeed, been such as to cause both surprise and admiration; but I think that they are the results of a system that would prove eminently a failure if applied in our own country; and as I flatter myself that I know something of the innermost details of the administration of that country, I have thought that it might afford you some instruction were I to give you an account of the municipal organisation of Paris. There is much to be learnt from what is passing amongst our neighbours, no doubt; there is also much to be avoided. It should be our duty to learn all that they do that is worthy of imitation, in order to place the administration of our capital upon as sound a basis as possible, after allowing for the different circumstances of the social organisation of the two countries.

The first things that strike the inquirer in the municipal organisation of Paris, are—1st. That the capital and two of the great cities of France constitute exceptions to the general law of *communes* that prevails in that country, and are administered in fact by what is called *le régime du bon plaisir;* and 2nd, that the "*régime*" in question is carried into execution by the instrumentality of the organisation that previously existed. Thus, in the other cities of France, the prefects have very little power; the maires and the municipal councils, which are freely elected by the public, have, in reality, the unlimited control of the funds raised from their fellow-citizens. In Paris, in Lyons, and Marseilles, however, the prefects of the department have a more direct action, and the *conseils municipaux* are nominated at the choice of the Emperor; the *conseils* have, in the latter case, only a consultative voice, which is easily controlled; the initiative of any improvement comes from the prefect, who is all powerful. Of course, the prefect is obliged to carry out the projects that he may form by the aid of the subordinate *employés* of the administration; and he is responsible, for the acts that he thinks proper to adopt, to the great tribunal of public opinion, which may be considered to be represented by the semblance of the municipal council that authorizes, or not, the measures for carrying into effect the resolutions of the prefect. But this system of control is very illusory, and it in nowise ensures that the resources of the towns should be laid out according to the wants of the population, or even according to their means of supporting the charges the works may involve. Hitherto, it is true, no inconvenience, or but very little, has been found to arise from this cause; because, in the first place, there had grown up in the cities of Paris, Lyons, and Marseilles, in the course of years, a state of things that made any change a change for the better; and, in the second place, because the prefects of those cities are all of them high-minded men, men of enlarged views, and men who could well understand the wants of the population whose welfare was entrusted to their care. But what would be the ultimate results of such a system, when the directing hand and head of the empire was withdrawn? It is impossible to speak in too high terms of the attention with which every want of the Parisian public, for instance, is considered. The Government is literally there a visible Providence, to interpose between the consumer and the producer; and it makes, as the French people themselves say, "*la pluie et le beau temps*" in affairs which we leave to the care of a real Providence, and try to shelter ourselves against as best we may. As far as they have gone, the results of the system applied by our neighbours have been satisfactory, and France has increased in splendour and in real comfort in a degree which passes belief; the worst of this system is that it depends upon the lives and the intellects of the men who carry it into effect, and it is always subject to the errors that they may commit in their appreciation of the wants of the community.

But it is hardly the place here to indulge in abstract theories of government, and our business is more directly concerned with the measures adopted in Paris to carry out the immense improvements of that city. As was said, the system of government consists in, first, a prefect of the *département de la Seine,* who is a senator, and is named directly by the government; second, in a *conseil municipal,* consisting of sixty members, under the actual presidency of M. Dumas, the chemist and senator; third, of the different members of the administration, that is divided into a number of services, all of which it will not be necessary to notice upon the present occasion, as they are connected with the duties of the prefect that concern other functions besides the execution of public works. The prefect, in fact, represents the town in all that concerns the action of the government, and in all legal proceedings that may be undertaken for the defence of the interests of the municipality. He is charged with the execution of the police, conjointly with the prefect of that department; with raising the taxes and the execution of the conscription, with the service of the national guard, with the administration of the hospitals, the public assistance, the public education, and, in general, with all that relates to the government of the town. In this he is assisted by the *maires* and *adjoints* of the different arrondissements of Paris, who are also nominated by the crown, but in nowise subject to the election of those they rule. As the division of Paris into *arrondissements* and *quartiers* will very frequently come under notice in the sequel, it may be as well to say here that the city comprises twenty arrondissements, each of which has a *maire* and his *adjoint,* and is further subdivided into four quarters in each arrondissement. As the duties that are fulfilled by the *maires* and *adjoints* are exclusively confined to their magisterial functions, excepting in so far as they prepare the lists of the electors, there is not much inconvenience found to arise from their not being themselves elected; but, as will be seen in the sequel, there are grave objections to the municipal council being nominated, and holding their office at the will of the Emperor.

When, under this system, it is determined to execute a great public work, the course adopted is as follows:—The minister in whose functions the building enters (for in France the Minister of the State, the Minister of Public Works, the Minister of Worship, the Minister of War, have to do with as many of the buildings of Paris as the Prefect of the Seine) causes his employés to study the project, make the preliminary estimates, attend the inquiry that is held into the necessity for the execution of the work, and then presents his estimate, and all the documents connected with the inquiry, to the Chambers, in cases where the national funds are concerned, or to the conseil municipal when it is only a question of the funds of the locality. In Paris, the course is for the prefect to transact this business with the chiefs of the department of the *Voirie,* at this time under the direction of MM. Tronchon and Deschamps, who are specially charged with the service of the setting out and regulating the streets of the city; but in every case the initiative proceeds from the prefect, who lays out the new lines of streets according to his own ideas upon the subject, and who is alone responsible for their direction to the Emperor. The project is then submitted to the Emperor in council, who decides whether it is of a nature to require the application of the law of public utility. The council of state orders an inquiry into this branch of the project, and, after hearing the various parties affected, it generally decides upon the question in favour of the prefect's design, and issues a decree to that effect. The project is then brought before

the conseil municipal, who decide upon the opportuneness of the execution and have to provide the sums of money that are required. The deliberation upon the project thus presented by the prefect to the municipal council is a mere *pro-formâ* piece of business; almost invariably the decision of the council is that the work shall proceed, and then the orders are given to mark out the ground, and to proceed to ascertain the indemnity that is due to the proprietors who are turned out. This is an operation that is done at once, after due notice has been given; but the purchase of the land goes on after the construction of the new street has been decided on, let the estimates be ever so much exceeded. Upon the completion of the formalities, the prefect takes possession of the ground, and he either yields it to the "*Compagnie concessionaire*," with the understanding that they will pay for the sewerage and water supply, the works for leading the gas to the public lamps, the execution of the roadway and footpaths, and the construction of the houses according to a plan determined upon; or he proceeds to the execution of these works by his own agents, and he, of course, receives the proceeds of the sale of the land that is reserved for building purposes. The latter course was adopted in the commencement of the great works of improvement in Paris; the former seems now the favourite with the prefect, as it leaves the municipality free to employ its credit and pecuniary resources, wherever he may think most desirable.

The execution of the works is divided into several departments, which consist of, 1st, the *Voirie*; 2nd, the service *des eaux et égouts*; 3rd, the service *du pavé*; 4th, the service *des promenades et des plantations*; 5th, the service *des travaux d'architecture*; 6th, the superintendent *des logemens insalubres*; 7th, the service des Ingénieurs des Ponts-et-Chaussées; and 8th, the service of the *Carrières*.

The first of these comprehends all that relates to the plan of Paris, and to the proposed rectifications thereof. It embraces the setting out of the new streets; the fixing of the lines that are allowed to prevail; the projections on the public way; the numbering of the houses, the acquisition of buildings that are acquired by means of expropriation; sales and exchanges of land, &c. There are employed in this branch of the administration, in addition to the two gentlemen already named, seven surveyors, or *géomètres*; nine surveyors, who are charged with the topographical works; four chiefs of sections; and a countless number of subordinates, who are charged with filling up the details of the service. As Paris is now undergoing the process of being surveyed thoroughly, the number of *employés* in this department is very considerably above the average; but the numbers given may be taken as representing the normal composition of this branch. There are, in addition to it, twenty architects *voyers*, and twenty assistants, or two to each *arrondissement*, who have, in their functions, the observance of the laws that regulate party walls, and the numerous cases that continually arise with respect to the right of air, ventilation, and light, and to the right of support by the neighbouring property, that are always the source of complicated action in the interior of great towns. It is this branch of the service, as was said before, that the prefect consults in preference to the rest, for all that relates to the improvement of the town.

The services of the *eaux et égouts*, of the pavement, and of the promenades and public parks, are discharged by engineers of the Ponts-et-Chaussées, or of the state, who are specially detached from the ordinary service, and are allowed to enter into the employment of the city of Paris, whilst they retain their rank and privileges as members of that body. I think it necessary to dwell a little upon this point, because an imaginary distinction has been sometimes drawn between the town engineers and the engineers of the Imperial Government. All the engineers of Paris are members of the Corps Impérial des Ponts-et-Chaussées, whilst the works of the Louvre, which in a recent discussion before the Committee of the House of Commons were especially alluded to, are all under the direction of M. Lefuel, who is an architect, and who is responsible alone for the success of them.

However, the three services named are united under the control of, at present, M. Michal, *Inspecteur des Ponts-et-Chaussées*, who has the general supervision, and regulates, as the last appeal, the various departments. He has under him, M. Belgrand, *ingénieur en chef de 1re classe*, who is charged with the *service des eaux et des égouts*, or in fact who takes the management of all that relates to the *underground* works of Paris. Then M. Homberg, *ingénieur en chef de 1re classe*, and M. Rozat de Mandres *ingénieur en chef*, are charged with the superintendence of the paving, roadway, and footpaths, or everything on the *surface* of the ground; and M. Alphand, *ingénieur en chef de 1re classe*, is charged with the plantations, seats, sheds, lamps, and generally with everything *above* ground; so that these four gentlemen have very distinct provinces, and yet they are all of them subject to the control of M. Michal, who has the title of "Director of Public Works." M. Michal receives from the prefect, after the formalities of the inquiry into the expediency of the proposed lines of communication and the reference of them to the municipal council, have been fulfilled, the indications of the direction that the lines are to follow; and at the same time, the plan indicating the exact line of the properties that the city intends to buy. He then consults the engineers of the various branches of his service, and they prepare in concert a project for the sewers, the water supply, the gas piping, and the plantations; they prepare estimates and designs for the work, which are submitted to the approval of the prefect; and, if approved of by him, are at once executed. The principles adopted in these cases are to shorten as much as possible the distance between the extreme points to be connected, and to regulate the level; and it must be confessed that in the new streets and boulevarts lately formed in Paris, this has been carried out with very little attention to economy in the laying out the lines, or in the levels given to them; but there are occasions when it is necessary to respect a public monument, or to preserve a certain gradient in order to accomodate a sewer, that may give rise to some deviations from the strict rule thus laid down. The engineers are, it must be added, directly interested in carrying out the works in the best manner, for they are charged with their maintenance, and their working afterwards; and as the city exercises a vigilant control over the sums allotted to this branch of the service, the engineers are kept thereby constantly on the stretch.

The bureaux that are immediately under the orders of M. Michal are not so numerously constituted as those of his subordinates, for he has only a general supervision over the works, and the engineers of the various departments prepare all the details of the execution; he has, therefore, principally to do with the accounts, and with the transmission of the orders of the prefect. In M. Belgrand's office there are three *ingénieurs ordinaires de 1re classe*, who are charged with the superintendence of the works that are in process of execution, and one other engineer who is charged with the construction and maintenance of the steam engines that are employed for raising the water; the laying the new pipes that are from time to time required is performed by the *ingénieurs* charged with the roadway, but under the orders of M. Belgrand, and they also exercise a control over the sewers, which come under that gentleman's direction, both for their construction and subsequent working and cleansing. As the gas pipes are laid in the soil, it follows that they also come under the province of M. Belgrand, who regulates everything that is concerned with what the French call the "canalization," or the pipes that serve to lead the gas to the places of consumption; the quality of the gas, and the manner in which it is to be burnt, form, however, part of the functions of M. Alphand, the engineer of the promenades and public plantations, and he is assisted by a host of inspectors, verificateurs, superintendents, &c., who are charged with the details of the private lighting. The details

of the *service des eaux et égouts* give rise to the nomination of a great number of employés, amongst whom the inspector de l'assanissement has a staff of seven assistants to superintend the communication of the houses with the drains or sewers; an inspector for the preservation of the hydraulic works that are connected with the distribution of that fluid in the fountains, the street plugs, and the pipes; an inspector who regulates the supply that takes place in the public offices and the departments of the state; eleven persons are employed in the office of the engineer charged with raising the water; twenty-eight persons are employed to receive complaints and reclamations, and to give the temporary orders for repairs of the pipes that are in communication with the private houses; 105 persons who are charged with opening and shutting off the water from the various places of distribution; and finally fourteen persons who are charged with the superintendence of the various reservoirs. The city of Paris, it is to be observed, undertakes the supply of the water that is consumed in that town, and it is now energetically at work to improve both the quantity and quality of the sources it resorts to; in the meantime it delivers the water to a company, which undertakes the works that are required by the subscribers for water, and accounts to the town for the payment of them. The company is paid for its intervention in the matter by an allowance which it retains upon the amount of the sums it accounts to the city for. The distribution is on the constant delivery principle, but it leaves a great deal to be desired on the score of height; indeed the tenure of house property in Paris is in fact opposed to the profuse use of water we are accustomed to in England, and the supply may be said to be more municipal than it is domestic. It serves to wash the streets and to feed the monumental fountains more than it serves the household wants of the inhabitants, who, by the way, have learnt to pass over the deficiency of many things that in England are almost necessities of life. There is a strict relation between the services of water and sewers which in Paris has received a good solution, so far as the removal of the refuse from the streets is concerned; but the whole of this subject is so complicated, and it would lead to details of such length, that I must reserve them for another occasion. I may here mention that the city of Paris has treated for the supply of gas with a single company, on very favourable terms for both that company and itself. The affairs of the company are at present under the management of M. Gayffier, an *ingénieur en chef des Ponts-et-Chaussées*, and of M. Camus, *ingénieur ordinaire*, of the same body.

The service of the "pavé" is arranged in the following manner:—M. Homberg, the *ingenieur en chef*, has under his orders five *ingénieurs ordinaires*, and they have the control of a certain number of *inspecteurs*, usually about two for each *arrondissement*, a number of *conducteurs* and *piqueurs*, about four for each *arrondissement*, and a number of *cantonniers*, about forty for each *arrondissement*. M. Homberg is charged with the superintendence of the parts of the town that were included within the limits of old Paris, but when the limits of the town were carried back to the fortification, the paving of the districts thus included was entrusted to M. Rozat de Mandres, who has four *ingénieurs ordinaires* under his orders, with the usual number of *inspecteurs*, *conducteurs*, *piqueurs*, and *cantonniers*. These gentlemen are charged with everything connected with the level of the streets, both longitudinal and transverse; they arrange the fall of the channels and the points where the water is to be delivered and to be conducted to the sewers; they have the choice of the material that is to be used, either paving or macadam, and they fix the manner in which it is to be swept and cleansed; they execute the borders, and they have a control over the execution of the footpaths that are under the special care of the householders, unless the city thinks proper to plant them, when they pass under the control of M. Alphand. In Paris the materials used for the roadways are the grès or sandstones of Fontainebleau, the porphyry of Belgium, the quartz rocks of various localities, the meullières of the Paris basin, and the bituminous rocks of the subcretaceous formations of Seyssel, Neufchatel, &c.; for the footpaths, they principally use asphalte, porphyry, and grès. The streets of Paris are models of cleanliness, and they may well bear comparison with those of London, or of any Dutch town, being managed upon a uniform principle, which our streets are deficient in. The gutters are carefully washed twice a day, and everything is removed from them before the inhabitants are abroad; and this is the more remarkable, because all the Paris houses are constructed without anything that corresponds with the dust bins of London, so that the Parisians are obliged to deposit everything in the shape of rubbish in the public streets. The engineer of the égouts, in fact, complains that his branch of the service is unfairly charged with the removal of much refuse that ought to be carried away on the surface; but this is a minor evil, which is amply repaid by the cleanliness and the good state of the roadways. Perhaps the street paving may be rather in a worse state than that of London is generally; but that is owing to the great expense of the materials employed in Paris; at any rate they never in that city expose their horses to the cruel task of wearing down the stones of their macadam, a system that prevails to a fearful extent, with loss to the parishes, be it observed, too, in our city that boasts so much of its civilization. In Paris the footpaths are, as was said before, under the special control of the householders, who can of course pave them in any way that they think proper; except in the new streets, where the city has executed them simultaneously with the roadways, and where the houses are made liable to a payment for their repair.

The bureau of M. Alphand, *ingénieur en chef* of the promenades and the public plantations, is composed of two *ingénieurs ordinaires* and a great number of inspecteurs, conducteurs, piqueurs, and cantonniers: there are also two architects, two *sous-inspecteurs*, one *inspecteur verificateur*, and a host of clerks. The attributions of the office are the superintendence of the planting of trees upon the boulevarts; the maintenance of the public parks; the establishment and maintenance of the public fountains; the decoration and the placing of the public lamps; the arrangement of the market places and the standing booths for public conveyances, advertisements, &c., in so far as they are unconnected with the building; in fact, the execution of everything that is concerned with the upper part of the public ways. In the discharge of these duties M. Alphand is assisted by the *ingénieurs ordinaires* of the *voie publique*, but as much as possible the services are kept distinct.

The *service des travaux d'architecture* is an important branch of the administration, but it does not exercise much influence upon the lines, or directions, of communication, excepting in so far as they may interfere with the existence of monuments of great artistic and national value; and it is for this reason, principally, that the advice of the architects is taken. Under general circumstances, the architect's business is confined to executing the public buildings on the spots that are designated for them by the prefect, and they have to prepare their plans, in conformity with the instructions they may receive from him, and in accordance with the limits of expense that he may judge advisable. At present, the *service des architects* is under the immediate presidency of M. Baltard, who has under him a *chef de bureau*, and a body of architects and inspectors charged with the maintenance of the Hotel de Ville and the various offices of the municipality. There are four architects-in-chief; one of whom has the direction of the buildings that are connected with the maintenance of public peace and the administration of justice; another, the building and maintenance of the places connected with public education; another, the places connected with commerce and the administration of the municipal laws and funds, such as the mairies,

tribunals of commerce, octrois, &c.; and the fourth, the superintendence of the religious structures. They are assisted by four *contrôleurs* and about 15 local architects, and two local architects are also named to superintend the departmental buildings; they have, as is usual in the French administrations, numerous subordinates, and there is quite an army of architects that is charged with the construction of new buildings; the number of these is not less than 33 at the present time, and it is calculated that the town has not less than 250 architects, conducteurs, piqueurs, and superintendents in its employment—the greater part being permanently engaged.

The superintendence of lodgings constitutes but a small branch of the administration of Paris, and it does not come into play at all in the improvements that have lately been carried on in that city; so that it will suffice merely to mention, in passing, that this object forms one of those that seriously occupy the attention of the prefect and of the municipal council. The works that form part of the attributions of the ingénieurs des Ponts-et-Chaussées, more directly concern the inhabitants of Paris, because they often blend themselves with the works executed by the engineers of the same body detached for the service of the town. Generally speaking the works that are required to connect the capital with other countries, and with the chief places of the several department, the lines of internal navigation and the railways, fall under the care of the ingénieurs des Ponts-et-Chaussées; and we therefore find that the service of the Seine is organized in several bureaux, that is to say, the ordinary service, the service of the navigation, the service of repairing and maintaining the bridges, the service of the superintendence of railways. In this number are included about eight ingénieurs-en-chef, and about twenty-four ingénieurs ordinaires, who discharge duties that are very variable, and are rather indefinite in their nature, because they somewhat interfere with the duties of their colleagues; however, although the engineers of the state are under the immediate control of the minister of public works, they are, nevertheless, to a great extent, subject to the Prefect of the Seine, whose consent is necessary for any great operations that they may be called upon to perform. The same thing may be said of the service of the engineers who are charged with the superintendence of the works that are required for the consolidation of the quarries under Paris; these are composed of the engineer-in-chief of the mining engineers and two ingénieurs ordinaires of the same body, and their duties consist in the superintendence of the catacombs and the foundations of the public buildings. It is found necessary to organize a special service charged with this duty, which the prefect is obliged to consult whenever a new line of communication is to be established; but it is only as a precaution, and to ensure the safety of the buildings about to be erected. All the last-named branches of the administration only have the right to interfere with the prefect when his measures are likely to trouble the public convenience or security; and therefore they are only mentioned incidentally on the present occasion.

But it remains for us to ascertain how the prefect manages to provide funds for the total change that he is effecting in the plan of Paris, and in the improvements there carrying out under his energetic management. In the first place, the revenues of the town are of themselves very large, and they have been pledged long since to meet such of the expenses as are authorised by the government; and in the second place, the city of Paris has entered upon the abuse of its credit, by the creation of a species of floating debt, that I think will end in bankruptcy. The yearly receipts of the town of Paris are (or were last year) 155,590,040 francs, or £6,223,600 nearly, which are raised from a population of not more than 1,667,841; and this, it must be understood, only represents the sums that the inhabitants pay for their local taxation, for the government taxes, that are levied directly from the payer, are quoted at the sum of 33,411,718 francs, or the additional sum of about £1,335,468. This sum of about six and a quarter millions would amount to an annual payment of about £3 15s. per head of the population, and it cannot be a matter of surprise that the expense of living in Paris is becoming rapidly unbearable. The incidence of the taxation is no doubt disguised by reason of its indirectness, but this only makes it more heavily felt by those who do consume the articles taxed. A man pays in Paris according to his consumption, not according to his means; and thus the rich man escapes contributing to the state. The poor man is forced to pay more in proportion than his neighbour. Of course Englishmen have nothing to do with the manner in which the French may levy the revenue that they may require, but it is right to call attention to the radical unfairness of the system, when so many people here are clamouring for the introduction of a similar one amongst ourselves. As it is, however, the rate of local taxation may be taken at nearly 50 per cent. on the rental of the inhabitants of Paris, including, however, all the relief of the poor, the expenses of the hospitals, the schools, &c., which with us are left to the care and charity of private individuals.

But it is to the creation of a description of municipal floating debt that the most impartial people lock with the greatest dread. The city of Paris, even now, has a funded debt that gives rise to the payment of 13,428,746frs., to defray the interest, and 10,314,892frs., for the sinking fund, or nearly a million a year is thus absorbed out of the 6¼ millions raised by the town. This is not all, however. The prefect has been allowed to issue obligations in the name of the city, and for the caisse des travaux de Paris, to the extent of 80 millions of francs, or for £3,400,000; and, if reports are to be credited, so far from his being contented with that enormous sum, he has extended it to the amount of 38 millions of francs (or £1,500,000 nearly) in the case of the works undertaken in the Boulevart Magenta. It is precisely the danger of this abuse of the credit of the town that is to be feared, and it is in this respect that the absence of anything like a controlling power in the municipal council of Paris is to be deplored. As the members of this body are all of them merely government nominees, and hold their places only as long as they vote the budget that is presented to them, the conseil municipal of Paris becomes nothing more nor less than a body chosen to give a semblance of legality to the proceedings of the prefect; it is utterly powerless to resist or to oppose any measure that he may have determined. Hitherto there has been no such result as was to be expected from this ignoble parody on municipal government, and Paris has gained in healthiness, in beauty, in convenience; in fact in everything that tends to make life valuable in large towns. The administration of the city funds is confided to a series of officers, who conduct their business with singular skill and attention to the public interests, though it must be confessed that they have allowed the spirit of red-tapeism, in the conduct of it, to gain the ascendancy; but these officers are not empowered to resist the will of the prefect if he should venture to step beyond the limits of his duty. They are only to discharge their functions; they have no deliberative voice, and they must carry into effect the orders that they receive from higher powers than their own. There is no kind of check upon the fancies or the caprices of the Prefect of Paris in fact, and it cannot therefore be a matter of surprise that he should have been misled in many cases, and should have made the mistake of confounding straight streets with good lines of communication, and broad boulevarts with efficient means of ventilation. I fear that much of what has been lately executed in Paris, especially in the neighbourhood of the Madeleine and the Parc Monceaux, is liable to this reproach, and certainly it would have been long before the town would have been thus modified, if the conseil municipal had been freely chosen, or if it had correctly represented the wishes of the inhabitants. There is, moreover, this danger about the course that our neigh-

bours have entered upon, that they have created a fictitious demand for labour of the highest and most dangerous class, which they must go on employing; and thus the necessity of always continuing the works at the expense of the town is a constant source of preoccupation to them. The true remedy to this state of things, to the danger of the gradual increase of the debt of the city, and the creation of the fictitious demand for labour, would be, in my opinion, to restore to the municipal council some sort of control over the money of which they are supposed to regulate the application. It is to the facility with which the prefect can create a new debt, and the utter absence of control over his proceedings in this matter, that the danger of the present state of affairs in the city of Paris must be attributed.

In the meantime, the results of the system, in everything that relates to the maintenance of the public works and the comfort of the citizens, must be considered to be as nearly perfect as it is possible to make it. The streets are admirably kept, their surface is admirably paved, and their gutters are washed and swept twice a day, so that every kind of obstruction to the flow of water in the channels is removed with the least possible delay. The footpaths are not so well organised as the roadways, on account of the law which regulates them; but this branch of the municipal service is under a gradual system of change, and the consequences of this are very apparent in the state of the footpaths of the new streets and boulevarts. The gas lighting is very well performed, under the direction of the town authorities, and it is carried on with such an amount of luxury in the district around the Louvre and Tuileries, that in the Rue de Rivoli there is a gas lamp at the distance of every fourteen feet, and in the courtyard of the new Louvre there is one every twenty feet apart; nor can this be considered exceptional, as there is the same profusion of light at the Bourse, at all the theatres, on the Boulevarts, the Place de l'Hotel de Ville, &c. The service des eaux et des égouts is very efficiently organised, and though Paris is still subject to the nuisance of the night carts, it is so in a less degree than formerly, and, at any rate, the inhabitants of that city cannot reproach themselves with the pollution of the river by their excreta. The water supply to the town is conducted, at present, on a very confined scale, but much of the inconvenience thus created must be attributed to the conditions under which household property is held in France generally. The city of Paris is, however, energetically at work to cause the insufficiency of its present supply to cease, which desirable object it is calculated will take effect in the course of the next summer. It would not enter into my province to notice the superior decency and cleanliness that are to be observed in the streets of Paris, which form so marked a contrast with the sights and scenes that one is compelled to witness in London; but this must strike every beholder, and give him a higher idea of the municipal organisation of the former city. There are ample provisions made for the markets, the cattle and the wine trade (and the former of these is now to be shortly brought to the immediate neighbourhood of the town); the factories are under strict superintendence, and they are kept from becoming nuisances to the neighbourhood in which they may be placed—in fact, the municipal affairs of Paris are managed with a degree of skill that must excite our admiration, in spite of the facilities that are afforded by the system on which it is based for the indulgence of the æsthetical fancies of the prefect, or of a much more august personage. It is to be feared, as has been said, that these will lead the city to great expense, if some check be not soon placed on them. Long lines of streets and long avenues, or boulevarts, cannot be constructed without costing a great sum of money; and though it may be desirable to terminate every vista with a building surmounted by a dome, in the style that seems to be the fashion in Paris at present; yet the question of the cost of these improvements must rise up before the inquirer, and the consideration is forced upon him, whether the circumstances of the town were, or are, such as to render necessary so great an outlay as these domes, and the houses around them, must cost? That which we should do well to imitate in the French system is, the order that prevails in the organization of their services for ensuring the fulfilment of the municipal duties; that which we ought to avoid is, the manner in which the Prefect of the Seine is allowed to dispose of the money of the taxpayers without any real control on their part of the funds so raised, or of the works that are undertaken avowedly for the public benefit. It may not be in the present day that the evil which will inevitably attach itself to the exercise of the irresponsible power of the prefect will be felt; it must, however, sooner or later, entail such consequences as are fearful to contemplate. As long as the system of irresponsible government is confided to intelligent and conscientious men, there possibly may not ensue from it the results that are to be apprehended; but this is always a matter of chance, and the results that would attend the corrupt, or even the unintelligent, use of the power so given must be evident to any one that reasons upon the matter. At present there may be questions raised as to the necessity, or the usefulness, of some of the public improvements executed by the city of Paris; as to the consequences of the future development of the system, it is to me evident that they must result in the embarrassment of the city and the augmentation of the burdens upon the citizens. The very perfection of the organization of, and the unity of system involved in, the services of the municipality seem to me only to disguise the defects of the system of which they form part, for they will allow the working of it to proceed, till it will at length collapse by the debt in which the prefect, or his successor, will involve the town.

I have not thought it worth while in this notice of the municipal organization of Paris, to describe the machinery that is put in motion for the purpose of making the inquiries into the expediency of declaring the works that the prefect may decide upon as being of the class that would come under the law of expropriation *pour cause d'utilité publique*, because the action of this machinery is very simple, and it is easily made to decide according to the wishes of those in power. The question of compensation for the property taken is in France, as in England, very much a matter of chance; that is to say it depends upon the skill with which the proprietor can make and support the claim that he may think proper to advance; for there is no rule by which the jury can fix the value of the land, or can ascertain the amount of the interest that may be attached to the properties or property under conditions that may escape observation. It is, however the general impression that the compensation that has been generally given in the cases of the new streets and boulevarts has been large, and ample for the purpose; so much so, in fact, that the proprietors of land and houses desire now to see the improvements carried on in their quarter, in the hopes of being expropriated in their turn. But this is in itself an evil, as the proprietors can only secure the high prices that they expect, on the condition of the public paying more for their property than it is worth; and the fact of some people getting more for their land does not compensate for the injustice that others may be exposed to. The system in France is, nevertheless so closely like our own in its essential features that I have not thought it necessary to direct your attention to it particularly. I have thought that the municipal organization of Paris, with all its strength, and with all its weakness, was a fit subject for your consideration; and as such I beg to recommend it to your careful study.

DISCUSSION.

Mr. NEWTON WILSON took exception to the introduction into the paper of so many French terms, which he thought would have been more intelligibly expressed to

the meeting at large in English. He had carefully observed the Paris system; and the immediate question which arose for discussion was the comparison of the results between the principles of management in London and in Paris, and the powers of the municipal bodies in those cities respectively. One thing he would especially refer to was the subject of gas. The inhabitants of London had been complaining—not without cause—of the monopoly in and the high price of gas, but they might look upon London as an elysium in that respect when compared with Paris. Gas in the latter city was as complete a monopoly as could possibly be conceived. The gas consumer in Paris was called upon, in the first instance, to deposit a certain sum with the gas company; he had then to pay the expense of putting in the service; and, in the next place, he had to deposit a further sum for the meter, amounting to about 6s. on every burner used. The result was that the gas company was able to divide about 30 per cent. on the paid-up capital out of the monies deposited by the customers as security against bad faith on their part. He quite agreed with Mr. Burnell as to the badness of the pavement in all but the very best streets of Paris. The huge square stones in the back streets were about the worst pavement that could be put down. In the boulevarts and principal streets the paving was, however, all that could be desired; and the barbarous custom of treading down the macadamised roads with horses and vehicles, as was done in this country, had happily been abolished in Paris.

Sir Thomas Phillips, Q.C., thought that just at the present time it required a large amount of courage to stand up in favour of the state of the streets of London, as they were certainly now in a particularly dirty condition. Notwithstanding the hypercriticism of the last speaker, he thought the paper was one of considerable interest; and the justification for the use of the French terms was found in the fact that these phrases applied to official persons, who were distinguished by the names there given to them, and all ambiguity was avoided by using the precise French description of their official position. The condition of the Paris of the present day, as compared with the Paris of twenty years ago, was a subject of considerable interest. Much of the change that had taken place was no doubt owing to the remarkable man now at the head of the French empire, who was now publishing to the world his history of the life of Julius Cæsar, but it would seem that he himself sought rather to resemble another Roman Emperor—Augustus Cæsar, whose boast it was that he found Rome brick and left it marble. It would be something of a similar result which the future historian of the French empire would have to record when he came to sum up the claims of the present Emperor upon the gratitude of the French people. There had been undoubtedly great improvements made in Paris. That celebrated writer, Madame de Stael, in her work on France, took occasion to describe the almost impossibility in her day of getting any public improvements in that country. The municipality met to consider the want of a new street or bridge; after much discussion they came to the conclusion that something must be done: but there must first be a report to a central body, the Ponts-et-Chaussées; and perhaps years might elapse in the various passages from board to board, and from office to office, before the work was either carried out or decided not to be done. In contrast to this, it had always been a distinguishing feature of our own country, that when any great public work was projected—whether it was a railway, a bridge, a dock, a canal, or a road—we did not go to a government board to get the work executed, but having once determined upon it, we carried it out ourselves. Undoubtedly there were in this great metropolis many examples of works done by the municipal bodies, but he thought in the majority of cases those works would have been better performed by associations of the people themselves. Moreover, it could not be matter of necessity that the streets of London should be in the condition they were in now; surely there must be a means of having something like central action. Take, for instance, the breaking up of the streets for laying down gas or water pipes; surely it was not necessary that in the best portions of the year main thoroughfares should be constantly broken up to lay down gas-pipes in the first instance. and re-disturbed at another time to lay down water-pipes. At the period when there was no Metropolitan Board of Works, and when there was no unity of action in these matters, he could understand the existence of these evils; but now he thought they might expect that these works should be undertaken with something like conjoint action and with a minimum amount of inconvenience to the public. In looking at the vast improvements that had been carried out in Paris, there was one subject which had been greatly neglected, and that was the effect of these improvements upon the great masses of the working people. In making a new street, large numbers of the working classes were displaced, without any means being taken to provide them with dwellings elsewhere. He knew that the inconveniences in this respect were very great in London at the present time. He had had occasion to sit for some of the local judges, and many cases occurred of applications for warrants for the ejectment of tenants from their habitations, which he was bound to grant; but no one could witness the extent of suffering occasioned by the inability of the poor man to provide himself with another lodging, without feeling that a great evil had been created by turning these people out of their dwellings—bad as these often were, and wanting in all proper sanitary arrangements—without any provision being made for their accommodation elsewhere. The House of Lords, acting—if not on a standing order, at least with a sense of its duty in that respect—required that whenever a railway or other public company took powers to pull down working men's dwellings, they should, in some shape, be bound to provide other accommodation for the persons thus displaced. While on this subject he would refer to the plan now before Parliament for concentrating the courts of law in London. It was, undoubtedly, an important project, and would be highly convenient to all who were connected with the administration of justice; but he hoped, in the prosecution of that plan, it would not be forgotten that a large number of the dwellings of the labouring classes would be pulled down, for whom it was the duty of the authorities to make some provision elsewhere. He believed that civilisation, as they called it, as it progressed in all its various stages, must tread hardly upon the poorer classes in some respects; but it behoved us all to take care that the pressure was lightened as much as practicable, and that in carrying out improvements for the advantage of civilization and progress, we did it with the least amount of sacrifice on the part of those who were not in a position to help themselves, and who had large claims upon our protection. With regard to the great works executed in Paris, Mr. Burnell had spoken of their great architectural beauty, but there were no doubt differences of opinion on this point. Many people like himself might regret that the picturesque features of the city, and the old historic associations connected with it, had been swept away. He did not mean to say that none of its ancient monuments had been preserved, but the great characteristics of the city seemed to have been wholly destroyed by the improvements that had been executed there.

Mr. Lavanchy could not but express his admiration of the observations which had just been addressed to them by Sir Thomas Phillips, but on going through the paper he felt there was one statement in particular in it which he could not allow to pass unnoticed. The impression conveyed in the paper was that the prefect was the leading if not the sole authority in all those matters of public improvement involving so large an expenditure of money. He was quite sure that an error of that kind had not been intentionally made, but the fact was, that any great public work of the nature described must be accepted and ap-

proved by at least three separate bodies or commissioners prior to its being laid before the Conseil d'Etât, and if approved by that body it was finally submitted to the Emperor, and, if sanctioned by his Majesty, was referred back to the prefect to be carried into execution. With regard to the cost of many of these great improvements it was well known that this was not borne exclusively by the municipality. The sites having been purchased by the prefect, they were re-sold by tender to companies or individuals, by whom they were disposed of to the different parties who built upon them. He thought it was much to be regretted that some such plan as this was not adopted by the Board of Works in regard to the public improvements in London. As to the large prices paid for land in Paris, he thought that was a matter which we were scarcely in a position to criticise, looking at the enormous sums demanded for building-sites in the City of London at the present time. We must first remove the beam from our own eye before we ventured to take notice of the mote in the eye of our neighbours. There was no question whatever that Paris had been very greatly improved, and history in calmer moments would do justice to the Emperor, and would acknowledge the debt which the French people owed to him.

Mr. Beloe congratulated Mr. Burnell on having introduced this paper on a subject which was deeply interesting to those who, like himself, were connected with municipal administration in the provinces. The anticipation of hearing this paper had brought him up from Liverpool, because, as a member of the municipality there, he felt that it would be most useful to them to learn what was done in other places, particularly in Paris. On the subject of the grand improvements that had been carried out in that city the paper afforded valuable information, but it did not state how the rates were levied upon the inhabitants for the purpose of these great improvements. He regretted to hear that the water supply of Paris was at present only on a limited scale, but that regret was modified by the statement than an augmented supply might shortly be expected. The water supply of Liverpool and Manchester was happily of the most ample and satisfactory kind, and had been carried out by the municipalities of those towns irrespective of the cost to the public. He regretted that the endeavours made by the Government some eight years ago to effect an arrangement with the water companies of London, by which, under the Board of Works, a general supply of water to London could have been obtained, had been defeated. He desired to express how gratifying it was to him to see the reading of papers of this kind encouraged by this Society, as it was most interesting to know what was being done in other parts of Europe, and he was sure great benefits must ensue from the introduction and discussion of so important a subject.

Mr. Webber ventured to think, judging from what they had heard in the paper, that, instead of these improvements resulting from municipal organisation, they had sprung, in fact, from an imperial organisation. He was struck with admiration at the picture of cleanliness and good order which had been presented in the early part of the paper, as regarded the streets of Paris, and began to blush for our own dirty thoroughfares; but when the cost was mentioned he became more reconciled to the present condition of things at home. It might be said that London had outgrown its municipal institutions. Hence there had of late years been created another and more extended authority, the Metropolitan Board of Works, which, however, had accomplished less than was expected of it. Could they not learn a useful lesson from what had been done by the municipal authorities of Liverpool and Manchester? In the case of the latter city a river divided the municipality of Manchester from that of Salford, but there was combined action, and the results were most favourable.

Mr. Nash apprehended that this paper had been brought before them with the view of their being able to derive some useful practical lessons from what was done in Paris. He thought the municipal institutions of London generally were very defective, and he inclined to the idea that the municipal administration should be made something analogous to the political constitution of the country—King, Lords, and Commons; that while the representative body should be elected by the people, there should also be an intermediate body, not elected, but which on all great matters should exercise its approval or veto. In Paris when a great work, such as a new street, had to be carried out, it was done in a far superior manner to London, for it could hardly be said that any one street had been properly laid out here, and until we could get good lines of thoroughfare London would never be beautiful and convenient.

Mr. Frederic Hill remarked that they had several instances before them showing that a despotic government, such as that of France, was not necessary to efficient action. There was the case of Manchester, where in the matters of the supply of water and gas, as well as in other respects, the municipal administration was most admirable. The same might be said of Liverpool and Glasgow, as also of some continental towns, particularly of Hamburgh, where municipal government prevailed to the fullest extent, and was entirely dependent on the will of the people. When the disastrous fire occurred in that city, by which a large portion of it was destroyed, the services of an English engineer were not only enlisted in stopping that fire, but the same gentleman was afterwards consulted by the authorities as to the best plan on which to rebuild the portion destroyed. The advice given was to adopt wide streets, building good houses, and taking a broad margin of land besides that absolutely required for the streets. The result was the handsome appearance which that city now presented, and the extra land taken rose so much in value that when re-sold it very nearly paid the expenses of the improvements made. The folly of the authorities of London in not acting upon similar advice given by Sir Christopher Wren, 200 years ago, was now universally admitted. He had had the advantage of seeing Paris at distant intervals, and had witnessed the wonderful improvements that had taken place in that city; the contrast he drew between London and Paris was very much to the disadvantage of his native city. In cleanliness, in the perfect order that prevailed in the streets, and in the absence from them of many of the disgusting exhibitions which were met with in London, Paris must be acknowledged to be greatly in advance of our own metropolis. At the time we were suffering from the offensive state of the Thames, he (Mr. Hill) called upon the Registrar-General, and stated his opinion that, however bad the state of the Thames might be, it was but a small matter in comparison with that of the vast area of the streets of London, by the dirty condition of which the public health was prejudiced. The Registrar-General admitted the facts, but avowed his utter inability to find a remedy, from the difficulty of getting districts and parishes to move in the matter, so that, under the existing municipal system it was almost hopeless to look for any permanent improvement in this respect. If they could induce one district to move he had no doubt the example would spread; but the thing was to make them start on the road to improvement. Mr. Hill also referred to the system of cleansing the streets in Rouen and Havre as worthy of imitation. On the subject of the election of members of the vestries and local boards of health, he thought an alteration of the present system was required; and he mentioned one parish in particular, in which he said the local authorities were elected almost entirely by the publicans of the parish, who appeared to have a repugnance to choosing really respectable people to represent them.

Mr. Hancock, in reference to the inquiry how the funds were raised for the improvements in Paris, stated that until recently they were derived entirely from the octroi duties. Not only were articles sent into France taxed at the frontier, but also provisions of all kinds at their en-

trance into the city. Hence the price of food within the city was considerably higher than beyond the barriers, where the octroi duties were not levied, and this had raised the value of land surrounding the city outside the barriers. He thought the people of this country would be very unwilling to submit to such imposts to carry out public improvements.

Mr. Jennings remarked that in dealing with the question of comparison, as between London and Paris, in the matter of public improvements, there were some material points which had not been considered. It had been observed that arbitrary power in these matters was the best power when well used, and that more could be effected by this means than by any other; but he trusted we should never wish to introduce arbitrary power into this country. With respect to the margin of land that should be taken in carrying out improvements, that which would apply to Hamburgh would not be applicable to London. The population of this metropolis was so large and so densely congregated that there were seldom any considerable spaces of yard or garden behind the houses. Where they could purchase poor property with large spaces contiguous, it might be profitable to take a margin for purposes of improvement; but practically in London it was far from profitable to purchase poor property. He thought in other respects more might be done in London than had been at present, if the Board of Works, which was comparatively a modern introduction, determined on some settled principle by which they could carry out a series of thoroughfares throughout the metropolis. That could not be done in the case of isolated improvements, but if they previously determined upon a comprehensive plan, it could be gradually carried on to completion. He did not agree with the view that no good streets had been planned in London. He thought the construction of Regent-street was satisfactory on the whole. Our difficulty up to the present time existed in the fact that the Board of Works had not the power to insist that streets should be laid out in a particular line. He thought it desirable that such a power should exist somewhere. He agreed that the Board of Works as at present constituted was not very popular, but there were very many able men on it, and he hoped they would be chosen as a committee to take up this important question. With respect to the dirty state of the streets, there was no necessity for its continuance. The streets in the City were swept every night, and he saw no reason why the same system should not be adopted throughout London generally.

Mr. Dalton was sorry to find that the Board of Works, of which he was a member, was still the subject of a considerable amount of censure, but he thought a little consideration of what they had done, and were now doing, would greatly alter the tone of those observations. They had been told this evening that the Board was answerable for the constant disturbance of the streets, in the laying of gas and water pipes; but he begged to state that they had no power to prevent this. Parliament gave gas and water companies despotic powers to take up the pavements where they pleased; and it was only by an Act passed the Session before last, that the Board of Works had power conferred upon them to prevent the entire stopping up of any street, without their sanction; previously to this, two great parallel thoroughfares—such as Holborn and Fleet-street—might have been blocked up at the same time. In the recent new streets formed by the Board, they had introduced subways, but these were opposed by the gas and water companies, and they would not use them when made. The Board could go no further than they had done in that direction. With respect to the great improvements carried out in Paris they had been told that a taxation of £3 15s. per head of the population had been the result; whereas the whole rates in respect of the main drainage and improvements of London did not amount to more than 9d in the pound on the local assessment, or about 10s. per head of the population. The Board was asked to make larger public improvements. Where was the money to come from? Would the inhabitants like to submit to octroi duties as they did in Paris? There was an outcry the moment an increase of the rates was spoken of. With respect to the Vestry, which was said to have been elected solely by the publicans of the parish, that arose entirely from the other parishioners not taking the trouble to look after their own affairs. It had been urged that the Board of Works ought to decide upon a comprehensive and definite plan of public improvements, but he might state that the Board had plans already before them involving an outlay of no less than £26,000,000. The present generation were called upon to bear the burden of the neglect of their forefathers. London had grown to a great extent without the thoroughfares being commensurately increased. The public were very hard upon the Board of Works; they would not give them the straw wherewith to make the bricks. The great work of the main drainage of London, for which the Board was originally constituted, was nearly completed. They had grappled with the question on which all previous Commissions had failed; and within the next two months the whole of the sewage of the south side, and two-thirds of that of the north side of London, would be conveyed away a distance of twelve miles below London Bridge. Much progress had also been made in the Thames embankment, which he did not hesitate to say was the finest work that was ever undertaken for London. The measures of the Board of Works would relieve the Thames of its pollutions; but their worth would to a great extent be nugatory if towns situated on the Thames above London were permitted to cast their sewage into its waters to be brought down by the stream. He hoped some legislative measures would speedily be taken on that subject.

The Chairman, in closing the discussion, said not the least interesting remarks were those of the last speaker, who had defended most ably, and, as he (the Chairman) believed, most accurately, the proceedings of the Board of Works, undertaken as they were under very great and special difficulties. A new system had been thus introduced into this metropolis which was calculated to produce effects almost, if not quite, as great as those in Paris, where the machinery by which they were brought about was such as would not be tolerated in this country. There was one observation in the paper which he did not think the facts brought before them justified. It was to the effect that Paris had gained in everything that tends "to make life valuable" in large towns. What had Paris gained? Some very remarkable streets and a great deal of elegant architecture. But let them see also what it had lost. Notwithstanding all the improvements in Paris, the sanitary condition of that city was inferior to that of London. How was that to be accounted for if London deserved the amount of abuse heaped on it? The real fact was that the health of the poorer classes was cared for in a higher degree in London than in Paris. Whatever might be the beauty of Paris, it was obtained by a heavy burden of taxation—enormously greater than in London—so great as to excite our surprise that it could be borne by the people. Although, however, the cost was enormous, the indirect return obtained by making Paris the centre of attraction for all the world ought not to be lost sight of. Then the question came, could we so beautify London as to make it a greater centre of attraction than Paris, and whether an equal expenditure in London would produce results equal to those at Paris? They must look to the matter of climate in the first place. London was subject to changes of climate and weather which were unknown in Paris. In the latter city the winter was cold, but dry and clear; in summer the heat was greater, but there were fewer wet days. In the matter of the cleanliness of the streets, the continuance of fine dry weather, both in summer and winter, was a great element. Then, again, there were questions involved as to the difference in the habits of the people. Would our population consent to be concentrated in flats, as was the case in Paris, with scarcely

a house occupied by an independent family? Could the habits of the people be so altered as to forego that domestic isolation which was so characteristic of the English? While we continued to have separate dwellings, London must necessarily be spread over a very large district, and its roads and drains must be of such great extent, compared with Paris, that the difficulties were increased in proportion. The gentleman from the north (Mr. Beloe) stated that he attended this evening in the hope of gaining some information on points of local government, and he had alluded with great modesty to the remarkable works at Liverpool and Manchester for the water supply of those great towns. They were the first two cities in England which had applied the principle of providing a water supply without regard to the cost to the individuals using the water. They had bought a large tract of country, the rainfall of which was collected in reservoirs, conveyed to Liverpool and Manchester, and distributed without stint to the population, the whole cost of the service being maintained by the municipal authorities. But could such a thing be done in London? The geological and geographical formation was different. Liverpool was by the seaside almost on a dead level, and its water came from a high district 30 or 40 miles to the eastward of it, and was brought down by the slopes to the town. They had no such geographical facilities in London, and it would be far more difficult to distribute water by the means employed at Liverpool than by the present system. When they talked of hindrances and delays in public improvements occasioned by Vestries and Local Boards, they must look at the fact brought before them, that in Paris every public work had to pass under the cognisance of no fewer than eight distinct boards or commissions; and, under these circumstances, it was to be inferred that there was as much obstruction in getting through improvements in Paris as there was in this country, with all its faults. For his own part, he would rather see some of our difficulties, and some of our dirt, too, than have the alleged facilities and cleanliness accompanied by the despotic power which prevailed on the other side of the channel. He was sure they would join him in a cordial vote of thanks to Mr. Burnell for his valuable paper.

The vote of thanks having been passed,

Mr. Burnell, in acknowledging the compliment, said that it was too late in the evening to attempt to answer the various observations that had been made upon his paper; besides that, in consequence of his infirmity of deafness, he had unfortunately lost much of what had been said. He would, however, take the liberty of observing, with reference to the observations made by Sir T. Phillips and Mr. Dalton, upon the advantage of placing the gas and water mains in the same sub-ways, that Mr. Belgrand, who had considerable experience in laying of both gas and water pipes in this manner, had last year given evidence before the Committee of the House of Commons against that style of construction. Mr. Burnell added that he himself witnessed, on the 25th of last month, the effects of a serious accident which took place in Paris, in consequence of the adoption of the subways, and he warned the public that there were many dangers attending them. In this case, the gas and water-mains were laid in a sub-way, that was formed in the spandrils of the arches of the Pont d'Austerlitz. For some reason, the gas company required to alter their main; they, therefore, proceeded to shut off the gas on both sides of the bridge, and they left the gas time to escape, as they thought; an explosive mixture was, however, formed, and upon a light being accidentally presented, an explosion took place; the results of this were that one man was killed, three were wounded and carried off to the hospital, the water-main was started, and the pavement of the bridge was torn up throughout its whole length; the damage to the company was said to have been as much as £10,000. With regard to the observations of the Chairman, he (Mr. Burnell) must persist in saying that Paris was a city in which life was agreeable; and as a proof of this, he would only mention the fact that the mortality of that city was now very little above that of London. It appeared from the returns for the three years, ending 1862, that the death rate per 1,000 in Paris was 24·913, whilst that of London for the same period was 23·077. Mr. Burnell, in conclusion, said that he should be happy at any time to answer any letters that might be sent to him on the subject that he had laid before the meeting in the course of the evening.

Proceedings of Institutions.

Leeds Mechanics' Institute.—The annual meeting was held on Friday, January 27th, the mayor (President) in the chair. Mr. W. J. Neild, hon. sec., read the report, from which it appeared that there had been an increase of 26 members during the past year in the subscribers of the 12s. class, and in the 5s. ladies' class. In the proprietary members and 15s. subscribers there had been a decrease. The general summary of the library issue showed a decrease in the number as compared with the previous years' circulation, the half this decrease being in fiction alone. There had been a great increase in language, the result of an addition to the library of French and German literature. The Committee regretted that, owing to the Telegraph Company having advanced the charge for telegrams 50 per cent., they had been compelled to discontinue them. They had, however, introduced a considerable addition to the newspapers. Twenty-four lectures had been delivered The balance-sheet showed a deficiency, on the whole of the departments, of £21 18s. 5d. Upon the year's income and expenditure there was, however, really a profit of £45 9s. 1d., which had been reduced to the above loss by the school fees, &c., accounted bad. The reports as to the state of the Boys' School, the Ladies' Educational Institute, and the various classes, were most satisfactory. The School of Art also continued to improve in numbers and efficiency; the number of pupils had increased to 7,430; by the return of statistics received by the Science and Art Department, the school had a larger number of pupils connected with it than any school in the United Kingdom; and it had the widest local influence of any school of art. The financial statement as to the different departments was as follows:—The institution proper, income £776 4s. 7d., loss £45 2s. 2½d.; ladies' school, income £789 19s. 8d., profit £55 16s. 7d.; boys' school, income £699 7s. 2d., profit £51 8s. 0½d.; School of Art, income £468 11s. 4d., loss £86 17s. 11d.; evening classes, income £85 5s. 6d., profit £2 16s. 7d.; the new building £2,540 1s. 2d., balance in hand £2,481 1s. 8d. A special vote of thanks was passed to the president, Mr. J. D. Luccock, Mayor of Leeds, for the valuable services he had rendered during the year, and a richly-mounted cane was presented to him.—A paper was recently read by Mr. James Hole, the successful competitor for the prize of £5, offered by the Mayor of Leeds, for the best essay on "The Dwellings of the Working Classes in Leeds," the adjudicators being Messrs. W. B. Denison, T. Dawson, and John Taylor. Mr. Hole announced that his essay would shortly be published, and would be illustrated by a series of engravings of Akroydon, presented by Colonel Akroyd, and of the Crossley Cottages, presented by Mr. John Crossley. Mr. Walter Smith, head master of the Leeds School of Art, had also promised to contribute some drawings of the buildings erected in Leeds by the Model Cottage Building Society.

THE ROYAL SCOTTISH SOCIETY OF ARTS.

The Society met in their hall, 117, Henry-street, Edinburgh, on Monday, 23rd January, Mr. Charles Cowan, President, in the chair.

Mr. Alexander Ramsay, Manager of the Water Company, and Vice-President of the Society, read a paper, entitled, "Observations on the Rainfall on an area of 4,504 acres in the Glencorse District, in the year 1863, and in the separate months of April, May, June, July, August, September, and October (being the period of the drought) of 1864," of which the following is a short abstract:—

The object was to show the quantity of water delivered in Edinburgh, the quantity sent down to the mills, the quantity run to waste during floods, and especially the quantity absorbed by the land or lost by evaporation. The circumstances influencing the absorption and evaporation of the rainfall, and necessarily the quantity of water the district will yield, are varied in their character.

The author laid before the Society the results of a series of observations in the Glencorse Valley, over an acreage of 4,504 acres. These observations extend over the whole of the year 1863, and the months of April, May, June, July, August, September, and October of the year 1864, showing the quantity of water in the two reservoirs in that district, the rainfall, the quantity of water yielded by the rainfall, the quantity of water delivered in Edinburgh, the quantity sent down to the mills on the Esk, the quantity run to waste, and the quantity absorbed or evaporated, with certain relative proportions of rainfall applicable to these separate items.

There are two reservoirs in that district—namely, Glencorse and Loganlea—and the drainage area treated of is divided into two portions. The first of these consists of 2,694 acres, draining in the Glencorse reservoir from the embankment upwards; the second consists of 810 acres, being the lower portion of the drainage area, extending from the Crawley cistern to the Glencorse embankment. The aggregate drainage area is thus 4,504 acres. In dealing with this large area, the yield of the springs is not separated from the general drainage water of the district. The spring water, including that of Crawley, may be estimated at 60 cubic feet per minute as a minimum, to 80 feet as its maximum yield.

The rainfall from 1st January to 31st December, 1863, was 39·3 inches. The average of the previous ten years, from 1852 to 1862, was 33 inches. The highest year in the series was 1856, when it amounted to 40·8 inches. The lowest was 1858, being only 27·65 inches. The year 1862 was thus 6·3 inches, or 19 per cent. above the average of the ten years.

The 39·3 inches represent 642,536,136 cubic feet, which was thus disposed of:—

1st. There was drawn off for town supply a uniform quantity of 253·56 cubic feet per minute during the whole year, amounting for the year to	133,271,136
2nd. There was given off for the use of the mills on the Esk 220 cubic feet per minute, or for the year	115,632,000
3rd. The quantity run over the Glencorse waste weir, derived from the 3,694 acres draining into that reservoir, as ascertained by daily gaugings, amounted for the year to	254,241,072
And allowing the same proportion for the 810 acres, between the reservoir and the Crawley water house, there falls to be added	55,748,583
Making an aggregate waste during the year of	309,989,655
Out of the total rainfall, therefore, these three items account for	558,892,791
4th. The deficiency therefore is	83,643,345

or 13·017 per cent. of the whole rainfall due, and due exclusively, to absorption and evaporation.

The rainfall for the year having been, as already stated, 39·3 inches, is accounted for as follows:—

1. There was appropriated in town supply	8·150
2. In supply to mills	7·071
3. In waste	18·964
4. In absorption and evaporation	5·115
Making up the total rainfall of	39·3

The quantity due to evaporation and absorption is smaller than the author was prepared to expect, and, no doubt, considerably below the average of ordinary years.

From the 1st April to the 16th October, 1864, a period of 199 days, the aggregate rainfall was only 10·89 inches, or at the rate of 19·974 inches in the year.

In order to bring into one view the leading particulars relating to the whole of the year 1863, and to the seven months from April to October inclusive in 1864, the following table was prepared:—

FALL OF RAIN AND APPROPRIATION OF RAINFALL ON AN AREA OF 4,504 ACRES IN GLENCORSE DISTRICT.

Cubic Feet of Water in Reservoirs on		Rainfall.	Cubic Feet of Rain.	Delivery of Water in Town.	Supply to Mills.	Waste by Overflow.	Loss by absorption and evaporation.	Absorption and evaporation equal to a rainfall of	Rate per cent. of loss by absorption and evaporation.
1863. January (1)	77,144,193	Inches. 39·3	642,536,136	133,271,136	115,632,000	309,989,665	83,674,843	Inches. 5·124	13·17
1864. April (1)	77,144,193	1·09	17,820,976	11,105,928	9,636,000	...	8,219,880	·50	45·90
May (1)	66,003,355	1·90	31,064,088	11,105,928	9,636,000	...	17,113,884	1·046	55·00
June (1)	59,211,631	1·45	23,706,804	11,105,928	9,636,000	...	18,218,879	1·114	76·80
July (1)	43,957,628	2·20	35,968,944	11,105,928	9,636,000	...	29,684,644	1·810	82·25
August (1)	29,500,000	0·65	10,627,188	10,310,840	9,636,000	...	4,579,348	0·280	43·00
September (1)	15,600,000	3·60	58,858,272	8,697,600	9,636,000	...	46,228,672	2·820	78·54
October (1	9,896,248	9·90	161,860,000	8,225,275	9,636,000	32,376,412	44,344,768	2·712	27·33

The mode by which the author had ascertained the loss was by accounting for the total quantity of water arising from the rainfall, and holding the difference between the rainfall and the quantity of water delivered in town, supplied to the mills on the Esk, and run to waste, as the loss due to evaporation and absorption.

In conclusion, the author stated that he greatly doubted whether there was any instance of a drought of a similar intensity and duration ever having occurred in that locality. During the whole seven months of its continuance, besides fulfilling their statutory obligations to the millowners on the Esk, the Water Company were able to maintain a supply to the inhabitants of Edinburgh, Leith, and Portobello, which only during six days, and these in the month of October, fell so low as 451 cubic feet per minute, or 20·23 gallons per head per day to a population of 200,000 persons.

Fine Arts.

Exhibitions.—The collective exhibition of the works of the late painter, Hippolyte Flandrin, is now open in the new building of the School of Fine Arts in Paris. The proceeds are to go to the fund for assisting unfortunate artists.—A fine art exhibition is announced to open at Alençon on the 20th of May next.—The twenty-ninth annual exhibition of the Rhenish Association commences on the 15th of April. This society carries round its collection to all the towns belonging to the Association, namely, Fribourg, Strasbourg, Mayence, Darmstadt, Mannheim, Carlsruhe, and Stutgard, allowing from twenty-five to twenty-eight days to each place, and completing its labours on the 19th of October.—Besançon opens its exhibition on the 15th of March; Bordeaux, on the 1st of next month; Mort, on the 1st of May; Saint Brieuc, in the same month; and Toulouse, on the 15th of June.—The exhibitions of Lyons and Pau are now open. The Central Union of the Beaux-Arts applied to Manufactures, whose recent establishment of a museum and library in the Place Royale was described in the *Journal* a few weeks since, announces its annual exhibition to be held in the Palais de l'Industrie in August, and offers 300 francs for the best model or design for the medals to be awarded on the occasion, and which are to be in gold, silver, and bronze.—A general exhibition of industry and industrial art is to open at Chaumont at the same time as the annual agricultural show, which opens on the 20th of May.—Lastly, the Polytechnic Society of Stettin proposes to organise a general industrial exhibition, under the protection of the Prince Royal of Prussia, to open on the 15th of May and close on the 30th of June in the present year. It is proposed to cover a portion of the cost by charging exhibitors a very small tax, regulated either according to the value of their contributions or to the space occupied by them.

The Cariatides of Salonica.—These well-known statues have been purchased by the French Government. Mr. Miller, who went out in May last on a mission from the Emperor, to make excavations in the island of Thosos, while waiting at Salonica for a boat to convey him to his destination, made a careful examination of the ruins of the Temple of the Cariatides, which for some years has been built against and enclosed within walls; he found the statues themselves deplorably mutilated, and it was evident, from the marks of recent fractures, that the work of destruction was progressing rapidly, and that before long these vestiges of ancient art would cease to exist altogether. Mr. Miller proposed to purchase them from the supposed proprietor, but this man asked such an exorbitant price as immediately put an end to that idea. Presently, however, it was ascertained that the Cariatides did not belong to the person in question, but to the Turkish Government, which, however, attached no value to the famous ruin, and had allowed it to be enclosed as above described. This fact discovered, Mr. Miller obtained the aid of the French Consul, the Marquis de Poncharra, and of the Pacha of Salonica, and, finally, with the assistance of the French Ambassador at Constantinople, Mr. Miller was authorised to carry the Cariatides to France. Another account of the transaction has appeared in the *Journal de Constantinople*, in correction of which the preceding statement has been published in a Paris paper.

Royal Academy of Belgium.—The Brussels Academy has issued its programme for the current year, and a portion of that for the succeeding session. The subjects selected for memoirs in the former case are:—1st. On the methods of teaching the graphic and plastic arts in the Low Countries and the province of Liège in all ages. 2nd. History of mural painting in Belgium, and polychromatic application to architecture, with the characteristics and methods of each epoch and each school. 3rd. The system of estimates for great architectural monuments erected during the middle ages, what portions fell to the architect or director of the work, and what were more particularly in the province of artists and artisans acting individually or in corporate bodies; also the modifications which have since taken place to the present time. 4th. History of landscape painting, with its progress and transformations, from the time it was employed as a mere accessory to that when it became a distinct study. The prizes are, for the first subject, a gold medal, of the value of 800 francs; for the second, 1,200 francs; and for the last two, 600 francs each. The subjects announced for the following session are:—1st. Analysis and appreciation, in a scientific as well as artistic point of view, of the principal methods of instruction in drawing which have been in use from ancient times to the present day; the value and influence of each. 2nd. Rubens as an architect. There are many buildings in Antwerp and Brussels attributed to Rubens—is this tradition founded on fact, or must the style which predominates in these buildings be merely attributed to the influence of the works of Rubens and his school?

Manufactures.

Exhibition.—At a general meeting of millers, to be held in Dresden, Saxony, in August or September next, there will be an exhibition of all mill productions, as well as mill stones, and all other implements connected with mills. Exhibitors from all countries are to be admitted.

Manchester Workmen's Exhibition.—On Monday afternoon, the 20th instant, a meeting was held at the Royal Institution, Manchester, for the purpose of opening an exhibition of productions contributed by working men. The lecture-hall was well filled. Sir J. Kay-Shuttleworth, Bart., presided, and there were present the Mayors of Manchester and Salford. the dean of Manchester, &c. The meeting was addressed by the Chairman, Mr. Alderman Heywood, and the Dean of Manchester. Amongst the objects shown may be mentioned some carvings of fruit and flowers, in Caen stone, by Mr. Green, a Manchester sculptor; a piece of stone carving, by Mr. W. Fasana, called "The Invader"—a serpent who is stealthily approaching a bird's nest; a carving of a dead canary, in box-wood, by a workman employed by Mr. Cowan; also one of Whittington listening to Bow bells. There are carvings in ivory, small models of steam-engines and machinery, architectural models of buildings, &c.

Midland Counties Industrial Exhibition.—A public meeting was held at Nottingham on Monday, the 20th instant, for the purpose of promoting a working man's industrial exhibition for Nottingham and the midland counties. There was a large attendance of the working classes, and several gentlemen addressed the meeting, strongly urging that such an exhibition should be held. A resolution in favour of this being done was unanimously adopted.

Standard of Electrical Resistance.—Copies of the standard chosen by the Committee of the British Association on Electrical Standards, appointed by the British Association in 1861, can now be procured by application to Mr. Fleeming Jenkin, 6, Duke-street, Adelphi, Secretary

to the Committee, the cost of a unit coil and box being £2 10s. The standard is a close approximation to 10,000,000 metre-seconds in Weber's absolute electromagnetic system, determined according to new and careful experiments made by different members of the Committee, and the copies are constructed of an alloy of platinum and silver, in a form chosen as well adapted for exact measurement. The want of a generally recognized standard of electrical resistance has been universally felt, and led to the appointment of the Committee, who now express a hope that the motives which have led to their present choice, and which are fully explained in the several reports published by them, will induce all interested in the progress of electrical science to assist in procuring the general adoption of the new standard.

Commerce.

Tobacco.—The exports from the United States of America during 77 years, in periods of seven consecutive years, are as follows :—

Average Shipments in Seven Years.

Period.	Hhds.	
1787—1793	87,836	The first period is the seven years after the revolutionary war.
1794—1800	71,131	Second and third, during the European war.
1801—1807	81,112	
1808—1814	31,141	Fourth, includes war with Europe of 1812, preventing shipments during last two yrs.
1815—1821	73,358	The fifth to ninth periods show a steady and constant increase during 35 years' peace.
1822—1828	85,207	
1829—1835	85,567	
1836—1842	100,423	
1843—1849	126,267	
1850—1856	116,274	Tenth, a decline, at the end of which, in 1857, prices reached their highest point ever obtained in the three markets, in proportion to quality.
1857—1863	139,552	The last shows an average increase over every preceding one, notwithstanding that during the last three years the markets of Virginia have been closed.

Alloys of Silver.—The increasing rarity of silver lately induced the French Government to form an alloy for monetary purposes, consisting of 835 parts of silver and 165 parts of copper, and pieces of 50 centimes, with the figures 835 stamped upon them, are actually in circulation. The fabrication presents no difficulty, the malleability is nearly the same, and the slight yellowish tinge can only be detected by rigid comparison. M. Eugene Peligot has been making experiments, with the view of substituting zinc for copper in the alloy. The process employed is very simple, and the results of combination in various proportions are said to be very satisfactory. The fusibility of the new alloys is greater than that of the alloys of silver and copper ; they are very sonorous, elastic, and malleable, and no verdigris is formed by contact with acids. The most economic method of restoring the coinage would be the employment of the old silver in the new alloy. One per cent. of zinc is already employed in the French copper coinage, and this small proportion suffices to give qualities to the coinage which copper does not possess. The small Swiss coins made at Paris contain zinc associated with copper, nickel, and silver. M. Peligot has formed alloys in the following proportions :—Silver, 950, zinc, 50 ; silver, 900, zinc, 100 ; silver, 800, zinc, 200. Ternary alloys—silver, 900, copper, 50, zinc, 50 ; silver, 800, zinc, 100, copper, 800; silver, 835, copper, 93, zinc, 72.

Colonies.

Tasmanian Products for the New Zealand Exhibition.—Recent accounts state that, though the subscription list is at present totally inadequate to the occasion, the products which have been sent in to the committee, or are ready when called for, are such as to be creditable to the colony, more especially considering the shortness of time allowed for appealing to the public. The list contains a great variety of Tasmanian timber in the shape of ordinary market woods, of blue gum and stringy bark, railway sleepers, &c., Florentine marble granite from the east coast, wheat, oats, barley, oatmeal, flour, ale, &c., Tasmania-grown field and garden seeds, silkworms, a wool press, a tobacco cutting-machine, &c.

Tasmanian Agricultural Show.—The annual exhibition of the Northern Agricultural Society, which is now regarded as one of the principal events of the year, came off at Longford on the 2nd November last, and was beyond every other show most successful. The exhibition of horses, cattle, and sheep was unparalleled. What with the large number and general excellence of the entries, the judges had no easy task to perform. The attendance was about the same as usual, upwards of 2,000 people being present, and comprised visitors and buyers from all parts of the island, even the extremities—Hobart Town and Falmouth. The amount of admission fees taken at the gate was £108.

New South Wales.—Agriculture.—The returns show that the wheat harvest was by no means so complete a failure from the rust as was generally anticipated. There was half a harvest—fully half of the average of the previous ten years. The produce is put down at 808,919 bushels; in the previous year it was only 1,054,954 bushels, and in 1856, the most productive year of the decade, it did not exceed 1,756,964 bushels. As the wheat harvest was known to be a total failure in some places, it seems to follow that in some others the damage done must have been very slight. The area of land put under wheat was 103,942 acres, less not only than in the preceding year, but than in the four preceding years.—The tobacco manufacture shows a very marked increase, the quantity produced in 1863 being 36,443 cwt. as against 3,755 cwt. in the previous year, and 1,587 cwt. in 1861. The principal seat of the manufacture is at Maitland. Recent attempts to grow tobacco on the Lachlan seem to promise favourably, and there seems every hope that the western district may become the seat of a prosperous tobacco agriculture as well as of a tobacco manufacture.—The quantity of sugar refined was 169,280 cwt., which was a slight increase over that of the previous year. There are five establishments in the colony, but only two of them were at work. This department of manufacturing industry would receive a considerable impulse if agricultural industry would but take the turn of sugar cultivation. Experiments tend to show that the soil and climate are admirably adapted to the growth of the cane, and that the profit on the operation would be far greater than can be obtained from any other branch of agriculture.

Obituary.

Mr. Samuel Gregson, M.P. for Lancaster, died on Wednesday the 8th of February. He was in his place in the House of Commons on the Tuesday evening. Shortly before three o'clock on the following morning he was seized with illness at his house, Upper Harley street, and died in three-quarters of an hour afterwards, in the 70th year of his age. He was the eldest son of the late Samuel Gregson, Esq., who filled the office of Mayor of Lancaster in the year 1825. Brought up in early life to rely on the result of honest perseverance and steady application, the character of Mr. Gregson was soon appreciated in the counting-house at Liverpool, where he commenced his commercial career. He was selected by his employers to positions of trust and confidence unusual for so young a man, and in course of time proceeded to Calcutta, where

he developed a business, and ultimately returned home, establishing a firm in London which carried on commercial operations of great magnitude in the China trade, and for many years has continued to hold a high and respected position. In 1837, Mr. Gregson unsuccessfully contested the borough of Lymington, in Hampshire, and in 1847 he was first returned in the liberal interest for his native town, Lancaster, but was unseated on petition. At the next general election he was again returned to Parliament, and has continued to represent Lancaster ever since. For sixteen years he advocated a reduction in the duty on tea; he felt that to tax heavily the produce of China, while the Chinese were compelled to admit our manufactures at a low tariff, was unjust, apart from an anxious desire to see his own countrymen supplied at the lowest cost with such an important article. Year after year, therefore, as chairman of the East India and China Association, Mr. Gregson urged the subject on successive Chancellors of the Exchequer, and in February, 1863, he presided over an influential meeting of merchants and others for the purpose of obtaining a reduction, and in a few weeks afterwards had the satisfaction of hearing, in unusually complimentary terms, from Mr. Gladstone that the tea duty was reduced to one shilling per pound. In a similar spirit, though with less success, Mr. Gregson has urged the importance of reducing the duty on salt in India. Everything connected with the East met with Mr. Gregson's earnest attention, and as one who had realised the tediousness of corresponding with India round the Cape of Good Hope, he justly appreciated the facilities of the overland route opened up by Lieutenant Waghorn; he was an early promoter of the Red Sea telegraph, and had recently been occupied in the important question of establishing railways in China. He was respected by all parties. Though making no pretensions as an orator, whenever he rose in Parliament he was always listened to with respectful attention; and his advice, particularly on matters connected with the trade of India, was highly valued. He was always known as a hard working member of the House of Commons, regular in his attendance, and zealous in the performance of his duties. The building of a beautiful church upon the Moor, at Lancaster, was due to his liberality, as well as some handsome baths and washhouses. He was elected a member of the Society of Arts in 1853, and served for some time on the Council, where his advice was highly valued by his colleagues, by whom his loss is much regretted.

Notes.

EXHIBITIONS.—PROTECTION TO INVENTIONS.—On Tuesday Mr. Milner Gibson, in committee of the whole house, obtained leave to bring in a bill for the protection of inventions and designs exhibited at certain industrial exhibitions in the United Kingdom. The Dublin International Exhibition (1855) Bill was read a third time and passed.

ROYAL SCHOOL OF NAVAL ARCHITECTURE AND MARINE ENGINEERING.—A course of three lectures, on "Magnetical Errors, Compensations, and Corrections, with special reference to Iron Ships and their Compasses," is to be delivered in the Old Lecture Theatre of the South Kensington Museum, on Thursdays, March 9, 16, and 23, 1865, from four to five o'clock p.m., by George Biddell Airy, Esq., Astronomer Royal. The subject will be treated under the following heads:—1. Terrestrial magnetism, and the magnetism of permanent magnets. 2. Transient induced magnetism of iron. 3. Sub permanent magnetism of iron. 4. Correction of magnetic disturbing forces. 5. Magnetism of ships, especially of iron ships, and correction of their magnetic disturbing forces on the ship's compass. At the close of each lecture, the Astronomer Royal will wait to give separate explanations to any individual members of the class. Though single lectures may have previously been given, it is believed that this will be the first course of lectures on this important subject which has been delivered in the country.

RAIN.—In the *Journal* of last week, under the title What is an inch of rain? appeared an extract from the weekly return of the Registrar-General, respecting the rainfall. M. Petit, the director of the Observatory of Toulouse, speaking of the late heavy rains, says:—"The quantity is not so unusual as at first sight would appear. The average annual fall is about 60 centimètres, rather more than two feet English, spread over about a hundred rainy days, thus giving an average fall of about six millimètres for each day, or about six litres, 10 to 11 pints English, per square metre. The average of the heavy rains of the 15th, 16th, and 17th of January, in the present year, rose to about nine millimètres. Greater falls have often occurred in France. On the 19th of September, 1844, 35 millimètres of rain fell at Toulouse in thirty minutes; and on the 10th of August, 1859, there fell 59 millimètres in two successive storms of about forty minutes each in duration. . . . In recalling the impression of terror created by the sight of a precipice, one is inclined to ask how it is that we are not terrified at such enormous quantities of water being suspended over our heads. But the question appears under a still more extraordinary aspect when we consider the amount of heat required to vaporise all the water which we receive in the form of rain. When we remember that in the tropics there falls about two metres of water per annum; that in our climate we have never less than 50 or 60 centimètres; and that the masses of snow in the polar regions must also furnish a great quantity of water, it will readily be admitted that the annual rainfall must be, at least, equal to a stratum of water all over the globe of 50 centimètres, upwards of 19½ inches English. . . It is easy, with these facts given, to see that the evaporation caused by the heat of the sun must render to the atmosphere about 175,000,000,000 cubic metres of water per day, or rather more than 2,000,000,000 of litres a second. . . And yet the furnace is 38 millions of leagues distant from us!"

TEA-MAKING.—A correspondent of the *Times* says he finds, from careful inquiry, that it is usual to brew 64 pints from 1 lb. of tea leaves, to which are added 4 lbs. of sugar and 8 pints of milk—72 pints in all.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Society of Arts, 8. Cantor Lectures. Professor Ansted, F.R.S., "On the Applications of Geology to the Arts and Manufactures." (Lecture IV.)
R. Geographical, 8½. 1. Mr. C. R. Markham, "On the Origin and Migrations of the Greenland Esquimaux." 2. Capt. Sherard Osborn, "Remarks on Dr. Peterman's letter on North Polar Exploration."
Actuaries, 7.
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity."

TUES ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Renewed Discussion upon Mr. England's Paper on "Giffard's Injector." And, time permitting, Mr. H. B. Hederstedt, "An Account of the Drainage of Paris."
Zoological, 8½.
Anthropological, 8.
Royal Inst., 3. Professor Hofmann, F.R.S., "An Introduction to the Study of Chemistry."

WED. ...Society of Arts, 8. Mr. F. W. Campin, "On the Means employed in taking Fish, especially with reference to Submarine Illumination.'
Royal Inst., 3. Prof. Marshall, "On the Nervous System."
Pharmaceutical, 8.

THURS...Royal Inst., 3. Prof. Hofmann, F.R.S., "An Introduction to the Study of Chemistry."
Antiquaries, 8.
Royal, 8½.
Linnæan, 8.
Chemical, 8. 1. Dr. Crace Calvert, "Action of Silicate and Carbonate of Soda on Cotton Fibre." 2. Dr. C. Calvert, "Bihydrate of Oxide of Phenyl." 3. Professor Bloxam, "Action of Chlorine on Arsenious Acid." 4. Mr. Church, "A New Cornish Mineral."
R. Society Club, 6.
Artists and Amateurs, 8.

FRI.......Philological, 8.
Royal Inst., 8. Mr. James Fergusson, "On the Temple and Holy Sepulchre at Jerusalem."
Archæological Inst., 4.

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Delivered during the Vacation 1864.

Par. Numb.
483. Post Office Savings Banks—Return.
494. Public Accounts—Report, &c.
498. Friendly Societies (England)—Report.
507 (A III.) Poor Rates and Pauperism—Return.
544. Army Medical Reports.
466. Schools of Art—Report.
518. Railway Companies Borrowing Powers—Report, &c.
553. Isle of Man—Papers.
66 (VIII.) Trade and Navigation Accounts.
82 (I.) East India (Native Princes)—Returns.
497. Carlisle Cathedral—Further Returns.
474. Revenue—Returns.
475. Public Debt, &c.—Return.
569. Remittance of Public Money (Great Britain and Ireland)—Account.
452. Joint Stock Companies—Return.
507 (A IV.) Poor Rates and Pauperism—Return (A.)
549. Land, Assessed, and Income Taxes—Return.
495. Scientific Institutions (Dublin)—Report.
556. Harwich Harbour—Correspondence.
513. Taxation of Ireland—Report.
512. Bankruptcy Act—Report.
493. Trade with Foreign Nations—Report.
66 (IX.) Trade and Navigation Accounts.
513. Taxation of Ireland—Corrected Pages.
481. National Education (Ireland), Part I.—Return.
380. Telegraphic Communication (India, &c.)—Correspondence.
479. Weighing of Grain (Port of London)—Report, Evidence, &c.
496 (I.) Dockyards—Index to Reports.
533. Pilotage (Newcastle-upon-Tyne Trinity House)—Correspondence.
455. Navy—Statistical Report on the Health.
481 (I.) National Education (Ireland), Part II. (Munster).
66 (X.) Trade and Navigation Accounts.
468 (I.) Education (Inspectors' Reports)—Index.
481 (II.) National Education (Ireland), Part III. (Leinster).
493 (I.) Trade with Foreign Nations—Index.
507. (A I.) Poor Rates and Pauperism—Return (A.)
377. Poor Law Unions (Ireland)—Return.
378 (I.) Metropolitan Subways Bill—Index.
551. Royal Union Mercantile Company—Correspondence.
5. Greek Loan—Account.
535. Newcastle-on-Tyne Pilotage—Correspondence.
532. Pilotage—Memorials.
446. Woods, Forests, and Land Revenues—Forty-second Report.
481 (III.) National Education (Ireland)—Part IV. (Connaught).
514. Navy (Ships)—Corrected Pages.
515. Registration of County Voters—Return.
416. Pilotage—Return.
66 (XI.) Trade and Navigation Accounts.
431 (I.) Cattle Diseases Prevention, &c.—Index.
535. Newcastle-upon-Tyne Pilotage—Correspondence.
507 (A VI.) Poor Rates and Pauperism—Return (A.)
513 (I.) Taxation of Ireland—Index to Report.
507 (A VII.) Poor Rates and Pauperism, &c. Return (A.)
243. Bills—Salmon Fishery Act (1861) Amendment.
244. ,, Titles (Ireland) (No. 2.)
North America (No. 18)—Further Papers.
China (No. 7)—Correspondence.
Chincha Islands—Further Papers.
North America (No. 19)—Further Correspondence.
China (No. 8)—Copy of Prince Kung's Answer to Sir F. Bruce's Memorandum.
Wall Paintings (Palace of Westminster)—Report of Commissioners.
Customs—Eighth Report.
Births, Deaths, and Marriages—Twenty-fifth Annual Report.
Inland Revenue—Eighth Report.
Commercial Reports (No. 7)—Reports by H.M. Secretaries of Legation.
Poor Law Board—Sixteenth Annual Report.
New Zealand—Further Papers.
Colonial Possessions (Part II.)—Reports.
Miscellaneous Statistics of the United Kingdom—Part V.
Mines (Great Britain)—Report.
Census of Ireland (Part 3) (Vol. II.)—Vital Statistics.
Trade and Navigation of the United Kingdom &c. (1863)—Annual Statement.
Childrens' Employment Commission (1862)—Second Report, &c.
,, ,, Third Report, &c.
Post Office—Tenth Report.
Public General Acts—Cap. 73 to 121 and Table.

Session 1863.

431 (B.) Poor Rates and Pauperism—Return (B.)
431 (D.) ,, ,, Return (D.)
493 (VIII.) Import and Export Duties—Return. Part (9.)
493 (IX.) ,, ,, ,, (10.)
538. Numerical List and Index, &c.
431 (B I.) Poor Rates and Pauperism—Return (B.)
431 (E.) ,, ,, (E.)
431 (C.) ,, ,, (C.)

Delivered on 8th February, 1865.
Patents for Inventions—Report of Commissioners.
Transportation—Correspondence.

Patents.

From Commissioners of Patents Journal, February 17th.

GRANTS OF PROVISIONAL PROTECTION.

Benzoic acid, manufacture of—263—F. A. Laurent and J. Casthelaz.
Boots and shoes—190—J. Edie.
Cereal grains, manufacturing syrup and sugar from—221—G. Haseltine.
Dyeing leather—168—T. Labrousse and J. Keily.
Earth, sand, &c., raising and carrying—174—L. Balma.
Engines, regulating and working the valves of—82—J. F. Spencer.
Fire-arms, breech-loading—247—S., R., and W. Trulock.
Flax, machinery for thrashing, &c.—231—W. Creasy.
Gases and vapour, producing—127—J. Young.
Grain sugar, system of boiling, in vacuo—42—J. Lebaudy.
Grapes, ground vineries for the cultivation of—204—C. T. Wells.
Horse hoes and corn drills (lever)—279—J. Sainty.
Iron and steel, manufacture and refining of—59—W. Baker.
Lamps and lanterns—151—J. W. Gregg.
Liquids, pumps for lifting and forcing—237—J. Hind.
Lubricating apparatus—274—E. P. Colquhoun and J. P. Ferris.
Metallic ores, purifying and oxidising—160—M. B. Mason.
Pencil cases—234—W. Clark.
Photo-sculpture—218—D. Gay.
Screw taps—257—W. Foster.
Skins or hides, fluting, &c.—172—J. Turney, jun., and G. Wood.
Steam boilers, apparatus for feeding—2789—J. Robinson and J. Gresham.
Steam engines, construction of—260—G. Davies.
Steam engines, &c., arrangements for coupling—159—A. W. Preger.
Street lamps, &c., method of lighting—65—J. Welsh.
Tap, elastic valve and high pressure—223—S. Sharp and D. Smith.
Throstle worsted spinning and doubling frames—162—E. Williams.
Woollen tissues, ironing and dressing—146—F. P. H. Cahuzac.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Velvet ribands, &c., winder for—389—T. A. and M. A. Verkruzen.
Files, manufacture of—412—W. B. Newbery.

PATENTS SEALED.

2067. J. Walker.
2071. C. W. Harrison.
2099. N. J. Peton.
2237. Z. S. Durfee.
2247. J. E. Morris.
2264. R. Holt.
2430. W. S. Cowles.

From Commissioners of Patents Journal, February 21st.

PATENTS SEALED.

2068. F. Feichtinger.
2077. R. M. Black.
2082. G. Parsons.
2086. W. Spence.
2089. E. T. Bellhouse and W. J. Dorning.
2095. R. Beard, jun., and W. Downing.
2100. R. A. Brooman.
2102. G. Davies.
2102. G. H. and H. R. Cottam.
2107. M. L. Muller.
2110. E. Hunt.
2112. R. Marshall.
2114. E. Calvert & T. Edmeston.
2116. P. A. le Comte de Fontainemoreau.
2139. J. B. Andreux and C. Coulon.
2170. E. R. and S. Lloyd.
2171. E. R. and S. Lloyd.
2181. W. H. Perkin.
2194. T. Taylor.
2244. J. H. Johnson.
2253. A. M. Perkins.
2355. P. A. le Comte de Fontainemoreau.
2424. W. Clark.
2452. H. Conant.
2648. J. E. F. Ludeke and D. Wilckens.
2929. P. Haggie and P. Gledhill.
3019. G. Haseltine.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

410. J. Cooke.
413. J. Chatterton & W. Smith.
423. E. T. Hughes.
461. H. Ward.
425. J. Combe.
571. H. Bowen.
719. J. Grant.
419. H., J., and R. Crawford, and R. Templeton.
465. R. and W. E. Pickin.
482. R. Foster, jun.
435. C. T. Marzetti and J. Watson.
448. J. Willcox.
459. J. Spence.
472. J. Kirkwood.
506. T. Watson and R. Dracup.
537. J. Tangye.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

279. W. Spence.
300. J. E. Boyd.
319. R. Griffiths.

Registered Designs.

Eardrop—Feb. 2—4689—Collins Brothers, Birmingham.
Pencil Clip—Feb. 3—4690—Michael Terrace, Birmingham.
The Spring Kingston Brace—Feb. 9—4691—W. Blenkiron and Son, 123, Wood-street, City.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, MARCH 3, 1865. [No. 641. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

March 8.—"On Cotton Gins." By Zerah Colburn, Esq.

March 15.—"On Marine Engines from 1851 to the present time." By W. Procter Burgh, Esq., C.E.

Cantor Lectures.

The Second Course of Cantor Lectures, the subject being "The Applications of Geology to the Arts and Manufactures," by Professor D. T. Ansted, M.A., F.R.S., is now being delivered on Monday evenings, at Eight o'clock, as follows:—

March 6th.—Lecture 5.—On Stratified Deposits of Minerals, as Coal and Iron Ore, usually obtained by Mining Operations, and on Mining Methods for such Deposits.

March 13th.—Lecture 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture.

Art-Workmanship Prizes.

In reply to the letter addressed by the Council to the principal City Companies, the following has been received from the Salters' Company:—

Salters' Hall, 14th Feb., 1865.

Sir,—The application made to the Master and Wardens of the Salters' Company, for aid in forwarding the endeavour of "The Society for the Encouragement of Arts, Manufactures, and Commerce," to improve the artistic taste and skilful manipulation of the art workman, by giving prizes for the best works executed from examples provided by the Society, was laid before the Court of Assistants at their recent meeting. The application was favourably entertained, and I have the pleasure to inform you that the Salters' Company resolved to become annual subscribers of ten guineas in aid of the fund for granting prizes for improving the artistic taste and skilful manufacture of the art-workman, and I enclose a cheque for the first year's subscription. I am, &c.,

Edw. Thompson,
Clerk of the Salters' Company.

To P. Le Neve Foster, Esq.

Proceedings of the Society.

Cantor Lectures.

Second Course.—Fourth Lecture.—Monday, Feb. 27.

Stones used in Construction, &c.

Professor Ansted commenced by stating that from the consideration of materials obtained from superficial accumulations, not regularly stratified, we pass to stratified and igneous rocks, removed either by quarrying or by mining, and he proposed to bring under notice the facts determined concerning stones used for constructive purposes. So far as their uses extend, these minerals may be grouped in many ways. They are required for constructive purposes—(1) as squared or rough stones, fit for building walls of houses, churches, and palaces; (2) for paving and roofing; (3) for road-making; (4) for the finer kinds of construction; and (5) for artistic purposes. The same kind of stone is often used for two or more of these purposes, but, as a rule, the less perfectly crystalline kinds, being cheaper and more easily worked than the others, are used for commoner purposes; the harder kinds, capable of receiving a high polish, being reserved for more artistic purposes. Commencing with building materials, we may regard them as of three classes—granite, sandstones, and limestones; but there is another division into two classes, namely, those worked by the pick or by wedges, and those worked by the mallet and chisel. The latter are freestones, and include marbles, limestones, and sandstones. The former include granites, quartz rocks, conglomerates, &c. Granites are procured on a large scale from Cornwall and Devonshire, where they are worked with facility and cheapness; others are from Peterhead and Aberdeen. Others, harder than either and of a darker colour, are from Guernsey, Malvern Hills, and Leicestershire. Granite consists of crystals of quartz, felspar and mica in crystalline quartz. The mica is frequently replaced by hornblende, the result being syenite. The felspathic portion of the stone also is sometimes *albite*, in which the alkaline element is chiefly soda instead of potash. Granite may be coarse or fine grained. Some kinds are brittle and others tough; some break along lines of natural fracture, while others resist regular fracture. Chemically, granite is a silicate of alumina and potash, with a little iron and lime, soda sometimes replacing the potash and magnesia the lime. To a certain extent, granites are mixtures of crystalline minerals in various proportions, and an average variety contains from two to three-fifth parts of crystals of quartz or crystalline quartz, about the same of felspar, and the

remainder mica. Granite possesses a mean specific gravity of 2·66, so that the cubic foot weighs 166¼ lbs. Fourteen cubic feet to the ton is the usual estimate. Its toughness is great, and varies much in different samples. Fresh unweathered granite will bear any direct crushing weight to which it can be exposed. Granite contains about 0·8 per cent of water, that can only be driven off by continued exposure to heat. In its ordinary state, and containing this quantity of water, it is still capable of absorbing about one-fourth more (or 0·2 per cent.), when placed in water for a few hours. Expressed in another way, a cubic yard of granite contains something more than 3½ gallons of water, and can absorb nearly a gallon more on being placed in pure water for a short period. To a small extent granite is soluble in pure water and hydro-chloric acid. The solubility of granite in pure water and hydro-chloric acid is among the tests of its value. A specimen was found to lose 0·25 per cent. of its weight in water, and 5 per cent. in acid. For various public works, as bridges and harbours, and for some public buildings granite is adapted, but its hardness and the cost of working, limit its use to works of practical utility where durability is essential. But good varieties require to be selected, and some granites are not more proof against weather than limestones. Basalt is a material used for rough walls and road material. In this rock a large percentage of iron is a prevailing feature, while the percentage of potash and soda is not excessive. The tough na ure of this rock, and the mode in which it weathers, leaving round lumps, separated by powdery rubbish, are due partly to composition and partly to the mode of formation of the rock. The columnar form of basalt is due to the same causes. Greenstones are varieties of basalt, and *trap* is a name given to rocks of this kind. All are useful for road metal. Of other rock not freestones, quartzites and quartz conglomerates, are rarely used for other than rough walls. Indurated schists are durable, but not ornamental, and very difficult to work into any convenient form. Indurated sandstones are more valuable and are occasionally employed in engineering works. Flag stones are valuable for paving, but not available for other purposes, except that they are sometimes used for party walls. These materials are hard, dense, non-absorbent, and resist atmospheric influences. They are, however, difficult to manipulate, and cannot be recommended except for special uses. Paving and road material must be considered among these. In quarrying granite the nature and position of the system of joints and natural fractures that affect the rock are important considerations, and depend on the geological axis of the district and the direction of elevation of the rocks. In granites only certain veins are valuable. These are of small extent compared with the mass of the stone, and are enclosed on either side by walls of inferior material. Granite is irregular in its composition; but the larger the mass the less are the irregularities perceived. In England the fine and durable qualities occur larger in Cornwall and Scotland than in Guernsey or Charnwood Forest, and the granite for extensive works should be sought for rather in the former than the latter localities. Freestones are stones that may be worked with mallet and chisel, and sculptured without difficulty. Of these some are crystalline, as the varieties of marble, dolomites, alabaster, malachite, spars, serpentine, &c. Of fine marbles only Carrara yields great supplies. Carrara marble is obtained from a quarry nearly midway between Leghorn and Genoa, and close to the bay of Spezzia. The quarries are very accessible. The veins of marble are in the Apennines, and include many varieties. The marble is quarried by first loosening the large masses by blasting, after which wedges are applied until the blocks are detached. The finest blocks are removed in the rough, but the others are shaped into oblong squares. From two to three thousand men are employed constantly in the quarries now in work, which number from thirty to forty for common kinds, and ten or twelve for fine marbles. The annual production exceeds 50,000 tons. Marbles of inferior quality are quarried like limestones. The best black are found in Derbyshire, where they form part of the carboniferous series. Red are rare and valuable. Yellow are chiefly found in Italy. The mixed colours are more common. There are numerous varieties found in England, chiefly in Derbyshire and Devonshire. Ireland also contains many. India is rich in marbles. On the continent of Europe, Belgium, France, Spain, Portugal, and many parts of Germany all yield excellent varieties, worked cheaply for ordinary purposes. Serpentine is used as a kind of marble. It is a silicate of magnesia, coloured by metallic oxides, of iron, nickel, and chrome. The Lizard rock contains veins of extreme beauty, remarkable for its brilliant colour contrasted by the purest white. The Italian serpentine (*ophite*) is different and far less brilliant. Irish Connemara marble is a variety of serpentine. Alabaster, of pure white or grey colour, and transparent, is a very beautiful material, very easily worked, and inexpensive, but it will not stand exposure. It is obtained in large quantities in England, but the largest and best supply is from Italy and Greece. Ordinary freestones are either limestones or sandstones; the former consisting of two groups—the limestones properly so called and the magnesian limestones, or dolomites. Of sandstones, the Craigleith is one of the best. It is obtained from the carboniferous rocks in the neighbourhood of Edinburgh. The colour is lightish grey, and the grain fine. The cement is siliceous. It contains 98 per cent. silica. The beds vary in thickness, the thickest being ten feet. The number of workable beds is very large. A cubic foot of the stone weighs 146lbs., and absorbs four pints of water. It resists crushing weights to the extent of 5,800lbs. to the square inch. It darkens by exposure to a smoky atmosphere and frost. It is an expensive stone. Other coal grits are good, but not equal in colour or composition to Craigleith. Stones from the old red sandstones, on the east coast of Scotland, are dark-coloured and flaky, but hard, and resist atmospheric action. Of these Dundee stone is dark-brown, owing to the presence of iron oxide. Arbroath is greenish grey; not objectionable. Very large blocks of uniform appearance may be obtained, for building and pavements. Yorkshire sandstones of the millstone-grit series are durable both for building and paving. The Stenton quarries, near Durham, have supplied good stone. The Park-spring stone, from near Leeds, and others from the neighbourhood of Halifax and Huddersfield, are good. These may be described as fine-grained stones, cemented with argillo-siliceous cement, coloured by oxide or silicate of iron, the colour varying from bluish green to pale brown. They weigh about 145lbs. to the cubic foot, and support a crushing weight about equal to Craigleith; but they absorb water readily and part with it freely, and are apt to peel when placed in walls. They are unsafe when in contact with damp earth, or where there is no circulation of air. Sandstones of the lower new red standstone series, consisting of fine siliceous grains with magneso-calcareous cement, are quarried at Mansfield, in Nottinghamshire. There are two varieties; one red, weighing 148½lbs. to the cube foot, and the other white and heavier. Both are absorbent, taking up from four to five pints of water to the cubic foot. They wear well, but are not safe in a moist, smoky atmosphere. At Liverpool much stone from this rock is used. A sandstone of the lower secondary period, better than most of the varieties from contemporaneous beds, is worked near Whitby, in Yorkshire, and largely exported. Of other sandstones, those of the Wealden period are irregular in their composition and easily acted upon by weather. Some of the sandstones of the cretaceous series are better. The Godstone and Maidstone fire-stones and the Chilmark siliceous limestone are very valuable for certain purposes. Chilmark is rather a siliceous limestone than a sandstone. It is heavy and non-absorbent. Sandstones, consisting of detached grains of indestructible material, cemented to-

gether by some foreign substance that has been held in water, depend on the nature of the cementing medium for their durability. Where this is calcareous or marly, or even irony, it is affected by weather, but where it is siliceous it is safe. When sandstone is laminated, water enters and ultimately produces disintegration. Many sandstones, ill-adapted for external walls and facings, are valuable as slabs, either for foot-paving, curbs, or other purposes, and also for party-walls. Limestones are better for ordinary constructions than sandstones; they are more easily worked, and therefore cheaper, more varied in quality and appearance; the useful kinds are more thoroughly distributed and the colour is more pleasing. Portland, Bath, Ketton, Barnack, and Caen varieties are the best known limestones in London and its neighbourhood. Their properties are very different. Many other stones are in local use, some from the carboniferous series and even silurian rocks. Even chalk is used occasionally for constructive purposes, in the interior of buildings. Portland stone is the hardest, the least absorbent, the most durable, and the most resembling marble of all English building materials. The upper member of the oolitic series in England, wherever it is developed, contains numerous bands of shelly limestone, partaking of that granular character which has been long known as oolite (eggstone). Some of these bands which are least shelly afford valuable building stone. The upper members of the Portland series pass into the Purbeck series (which contains "Purbeck marble"). Portland stone is heavy, weighing from 135 to 148 lb. to the cube foot. It absorbs about $6\frac{3}{4}$ pints of water per cube foot. It is composed of 95 per cent. carbonate of lime, with rather more than 1 per cent. of silica and carbonate of magnesia. It can be obtained in blocks of any size, and can be worked either by the chisel or the plate saw without difficulty. It is, however, expensive. It bears a pressure of 3,279 lb. without crushing. The heavier beds are the most durable for house architecture, but the upper beds, or roach, are preferred for some purposes, especially docks, piers, and other hydraulic works. The roach is less oolitic, and its cementing medium more perfectly crystallized than the other stone, and it resists alternations of dryness and moisture; but is less sightly, and could not be trusted in exposed situations in the air. The best quarries of Portland stone are on the eastern side of the island. Bath stones are next in importance to Portland, and their cheapness, facility of working, abundance, and pleasing appearance, have caused them to be adopted throughout the south of England, wherever they could be conveyed at small cost. There are numerous quarries, and the qualities differ a good deal. They occur at intervals in a series whose total thickness is from 60 to 120 feet. The series is as follows:—

1. Upper rag stones..................	thickness	25 to 50 feet.
2. Fine freestones or building bed	,,	10 ,, 30 ,,
3. Lower rag stones..................	,,	25 ,, 80 ,,

Bath stone is of a rich cream colour, and so soft that it can readily be cut with a tooth saw. It is lighter than Portland, weighing 123 lb. to the cube foot. It is absorbent, taking up $8\frac{1}{2}$ pints of water to the cubic foot, or more than one-sixth of its bulk. It bears a crushing weight of 2,000 lb. per square inch of surface. The upper ragstone is coarse, shelly, and irregularly-bedded, and contains no workable beds. Immediately below are fine-grained building beds. The lower ragstone includes numerous well-defined shelly beds, resting on the Fuller's earth. The importance of determining the geological limits of the freestone beds renders this identification of the lower and upper ragstone important. The lower beds have the appearance of fine-textured oolitic limestones, but are singularly liable to injury from exposure. At Box and Corsham quarries they are 40 feet thick. Bath stone decays very rapidly, but by allowing the surface to harden it is much improved. The consumption of Bath stone at the present time exceeds 100,000 tons annually. Caen stone resembles Bath in colour, texture, and facility of working. It weighs 120 lb. to the foot cube, and its resistance to crushing weights is superior to Bath. It is also harder and less absorbent. It is obtained near Caen, with other stones from the neighbourhood, of inferior quality. These are extensively used. Only small blocks of the best qualities can be obtained. Buckingham Palace and several London mansions were built of poor Caen stones. All these stones are remarkably pure and not very shelly. The carbonate of lime is sub-crystalline, and threads of calc spar traverse the stone at intervals. The inferior oolites yield good building stones in the west of England, but they are not superior to Bath stone. Barnack, Ketton, and Ancaster are midland oolites that have reputation; the first named is now replaced by stone from the Casterton quarries. This stone is of a lightish brown colour and compact oolitic structure, and is made up chiefly of fragments of shells and corals. It is heavy, weighing more than 130 lb. to the foot cube. Its resistance to crushing weights is not more than 1,500 lb. Barnack stone has been used in Cambridge, and also in Suffolk. Casterton is believed to be equally good. Ketton stone is brought to London, and some modern buildings of it seem to stand well. Its colour is warm cream. It is lighter than Barnack, and rather superior in resistance to crushing weights. Ancaster is superior in some respects, and equally durable, but has not been much used in London in important works. All these stones are absorbent, taking up about one-sixth of their bulk of water. They are expensive to work as compared with Bath stone, but considerably cheaper than Portland. Excellent oolitic building stones, of bluish tint and fine grain, are found and worked in Yorkshire for engineering purposes. It is not easy to ascertain the value of oolites. In the quarry or immediate neighbourhood they wear well, but when removed, and used carelessly, they resist frost very badly. The number of quarries is large, and the stones of the adjacent quarries are by no means of the same quality. Careful selection is necessary, made with a knowledge of the peculiar properties of the stone. Thus some coarse stones absorb little water, while others, far superior in appearance, suck in water like a sponge and soon decay. In quarrying the oolites, operations are carried on resembling those required for mining; but as large blocks are the most valuable, some difficulties arise which do not occur in mining. In working for stone, it must first be decided whether the stone is to be reached by drifts or by open cuttings. If there is a thick covering of upper hard beds, open quarrying is impossible, and in that case the work is carried on by tunnels. Open quarries, however, are common enough, but there is always a large quantity of waste material, whose removal is a matter of consideration before opening a quarry. In getting Bath stone the quarryman commences operations at the roof, picking it out six or seven feet back. The width of the stalls depends on the nature of the stone. The stone is afterwards cut with a saw, and removed with great care. Besides the limestones used for building purposes, at Bath there are also bands of more compact stone fit for roofing and paving. These flags are inferior to those found in Yorkshire, and to the slates from Cumberland and Wales. Stonesfield slate is one of these. The evenly-splitting flaggy structure is the only important fact. Lithographic stones are worked in large quarries in Bavaria. They are in thick beds, and are remarkable for the extraordinary smoothness and fineness of grain of the surface, and its delicate cream colour. They belong to the upper division of the oolites. Other lithographic stones of inferior excellence are obtained from liassic limestones. Limestones of the tertiary period are not met with in England, but excellent qualities are worked in various parts of the Continent. In and around Paris the limestones of the older tertiaries are opened in extensive quarries, from which the capital is supplied. The stone is of good colour, even texture, and easily and cheaply worked, but does not resist perfectly even the

comparatively pure and dry atmosphere of Paris. Chalk becomes hard and adapted for building purposes in the south of France, and hard white cretaceous limestones are found throughout the middle and south of Europe, available for construction. Many of these are compact and very durable. Compact carbonates of lime in England are chiefly members of the carboniferous series, and pass into marbles. Good lias supplies compact material, usually argillaceous, but the middle beds or "marlstone" yield a limestone. All the stones are absorbent, and are rapidly injured by exposure to moist air in changing temperatures, and especially when there is frost. Magnesian limestones occur in the middle and north-east of England. They consist of a variable proportion of carbonate of lime and carbonate of magnesia, and have been used in recent important buildings in London. Their colour is light brown, of warm tint; their density is greater than that of the oolites; the labour on them is intermediate between gritstones and Portland, and they can be obtained of any required size. They are four times stronger than Portland; certain parts of Derbyshire, Nottinghamshire, and Yorkshire, yield this kind of stone. It was used for the Houses of Parliament and the Museum of Economic Geology in Jermyn-street. The stone in the latter building is extremely good. It is well known how great is the failure in the other building. Whether from more trying exposure, or from the quarries ultimately worked not yielding stone like the sample, it is too late to discuss. The best magnesian limestones are those in which there is at least 40 per cent. of carbonate of magnesia and 4 or 5 per cent. of silica. But the composition alone is of less importance. Where this is complete the stone resists attack, but it is an unfortunate peculiarity of the admixture that it is never the same for many yards together, even in the same quarry. It is desirable to obtain a test of the relative value of stones to be used for building purposes. An attempt was made by M. Brard to determine the relative durability of limestones and sandstones having calcareous cements. This method consists of boiling small cubes in a saturated solution of Glauber's salts (sulphate of soda), and exposing the cubes in the air. The effect of expansion by the efflorescence of the salts, as the water evaporated, tested by weighing the amount of material removed from the stone in a given time, measures the effect of frost. It has not been found that the result can be depended on for practical purposes on a large scale, and it is now seldom resorted to. Slates belong to argillaceous minerals, and are completely metamorphosed so as to have lost all external marks of mechanical origin. In them bedding is replaced by cleavage. They split into thin plates, in planes parallel to each other, independent of original stratification. Those that split into the thinnest plates are used for roofing purposes, and those which yield slabs, for paving and walls. Slates of good quality are not very common, and unless accessible by sea, and there are means of getting rid of the rubbish resulting from the workings, they cannot be quarried with profit. They are limited to certain veins of comparatively small dimensions, in the midst of a considerable mass of schistose rock. Slates are generally from rocks of very ancient geological date, but this is not invariable. The best slates in the London market are obtained either from North Wales, from the north coast of Cornwall, from the west coast of Scotland, or from Valentia, on the coast of Ireland. Very good sorts are found in France, in the Ardennes, in Western Germany, and in the east of Europe. America also yields supplies. Slate hardly weathers when placed horizontally, unless exposed to foot-wear. In the better qualities of slate there is little or no pyrites, and the veins and joints are so arranged as to assist in the working. The best slates are obtained from some depth within the quarry, and in valleys rather than on hills. Exposed and weathered slates seem to have lost much of their fissile properties. All stones are injured by long exposure to the weather; and in considering the best method of keeping back decay, the composition and state of aggregation of the rock must enter into calculation. The causes of decay are partly chemical and partly mechanical, and include—(1) the action of rain-water, either by friction or dissolving parts of the stone; (2) disintegration of the stone by the action of frost. Rain-water again acts in two ways, decomposing by acids or disintegrating by efflorescence. All deserve consideration, and depend on the absorbent nature of stones. It is by capillary attraction that water is sucked into stones, and there are limits to this attraction. Together with the water its contents enter, but are left behind near the surface. When evaporation takes place from the surface, it is only the pure water that passes off. The foreign substances are left behind, and produce their effect in time. Rain-water contains carbonic acid gas and ammonia, and, however small the proportion may be, everything that can be affected by these substances will yield in time. Thus, even in granite, the silicates become decomposed and the felspar destroyed by the constant action of rain-water, and when the felspar is gone the rock will become rotten. Such is the case in the islands of Alderney and Jersey, in the British Channel. But if granite is destroyed, much more so are sandstones with calcareous cements and limestones. Owing to the quantity of coal burnt, and the impurity of the coal, there is always a certain proportion of sulphurous acid in the air in towns, and this becomes dissolved in the rain as it falls, and rapidly affects the carbonates of lime. This action going on every day, with every change of weather, the surface of the stone, bruised by the action of the tool, and deprived of the only protection nature is able to give, very soon disintegrates. The less homogeneous the stone, the more injured is it by this kind of action. The disintegration by the action of acid vapours would be slow were it not for the alternate expansion and contraction of the moisture contained in it. And this result is obtained in its maximum when the stone is so placed that the moisture is nearest the surface, which will happen when the stone is placed at right angles to this natural direction. Great care should therefore be taken by the builder to place the stones as nearly as possible in their proper position. The injuries that take place in absorbent stones from chemical reactions, are not easily traced, but are not inconsiderable. The various substances accidentally present in stones may become changed by the chemical action of salt contained in the absorbed water, and thus injure the stone and increase its tendency to decay. Many stones suffer efflorescence due to this cause. Loamy clays, places where sand has been used in mortar, or where salt can in any way have been absorbed, and stones in which an unusual quantity of organic matter is present, are liable to this cause of mischief. Efflorescence, from whatever cause, is certain to bring away detached fragments of the stone loosened by weathering. Whatever be the cause of the destruction of stones, it may generally be traced to the absorption of moisture, and thus any contrivance that will check the admission of water will be the most likely to succeed in preserving the material from decay. Many such contrivances have been proposed; they all involve some of these principles:—(1) closing the pores of the stone by some kind of paint; (2) coating the stone by some insoluble mineral substance; (3) defending the stone by causing it to absorb a chemical solution, which, on the application of another solution, becomes decomposed and deposits within the stone an insoluble coat. Paint, by preventing the absorption of water, preserves stone so long as it remains undecomposed. In London this hardly amounts to three years. The injection of oily and fatty matters acts in the same way and lasts only a little longer. There have been cases, where the exposure is not severe, and where the treatment has been adopted before the absorption of moisture, where the result has seemed permanent; but for buildings intended to last, such treatment is useless, as it can only stave off the evil day for a time comparatively very short. About

twenty years ago Professor Kuhlmann applied fluid silicate of potash to harden chalk and porous stone. On soaking chalk with the fluid silicate, a change took place, the face of the chalk becoming converted into silico-carbonate of lime. In practice, this method failed when applied to buildings, because the weather cannot be depended on, and a dry atmosphere is needed during the whole period of hardening. Not long after this had been done in Germany, Mr. Frederick Ransome, of Ipswich, attempted to deposit an insoluble wax, by means of another solution, which should act by double decomposition. He found that by following the silicate by a dose of chloride of calcium the chlorine parting from the calcium attacked the soda of the silicate, forming common salt, while the silicic acid combined with the lime and formed with it silicate of lime, a mineral nearly insoluble, very hard, and adhering with great tenacity to foreign substances. The effect of this treatment on stones that have not already been inserted into buildings has been very favourable, but applied on a large scale to buildings that have already shown symptoms of decay, the result is less satisfactory. A combination of Kuhlmann's process with a temporary wash of bituminous substance, has been tried on the Houses of Parliament by M. Szerelmy. It remains to be seen whether this result will be more satisfactory than that of Mr. Ransome. Besides the varieties of schist and slates used in construction, there are slates loaded with hydro-carbons to so great an extent that the rock will take fire on being exposed to heat and flames. Such rocks are generally called *bituminous shales.* They occur in rocks of all ages, are of various thickness, and exist under very different conditions, but in a general way they may be regarded as clay bands in sandstone rocks, into which a large infiltration of hydro-carbons, and occasionally much iron, has taken place subsequent to the deposit of the rock. Till lately these shales have been of little value, and have attracted no attention for commercial purposes, only those being valued in which the iron was sufficient to enable them to be used as ores of iron. Since the manufacture of illuminating and lubricating oils has been carried on, such shales as yield a sufficient percentage of oils on distillation to be worth working are among the sources of mineral wealth in the neighbourhood where they occur. From the tertiary rocks we have the paper-coal, used for distillation in some works nearly opposite Bonn, on the Rhine. From the cretaceous beds other shales have been worked, though to no great extent. The oolites are richer in bituminous strata. In the Kimmeridge clay there is a band of highly bituminous shale, of dark brown colour, and without lustre, burning readily. Part of it is called "Kimmeridge coal." The lias is richer in shales of the kind, and the "Posidonia schist" has been brought into use for distilling in Wurtemberg. It is chiefly rocks of the carboniferous series that yield the richest of these deposits. In Scotland, near Edinburgh, there are varieties of coal that pass so nearly into shales, and shales that so accurately put on the characters of coal, that it becomes difficult to distinguish between them. The well-known Boghead coal, and the Torbane-hill mineral are examples. These are either shales or coals, according to the line that may artificially be drawn between coal and shale. They are rich in the products given off by distillation at a low heat, and are ill-adapted for fuel. Many other minerals, departing more widely from coals in appearance, are called in Scotland "parrots," or crackling coals, and in England "cannels." When once set on fire they burn freely, with a bright flame and much smoke. They are easily distinguished from coals, but are more valuable than coals themselves for distilling. In the coal-fields of Lancashire, North Wales, and the Potteries, many such bands have been recognised. Some of them are rich in iron, and the iron stones of these and other coal-fields, including the "black band," are highly bituminous. The bituminous shales hitherto made use of in England are almost entirely from these black and brown bands in the coal measures, but this is not the case elsewhere. In the east of France, near Autun, not far from Dijon, there has long been a large manufacture of oils distilled from schists, quite independent of the coal. They have no resemblance whatever to coal, but one of them resembles the Scotch Boghead. Other cases exist in the west of France, where similar shales have been distilled. Good bituminous shales rarely soil the fingers; they are brown when scratched with a sharp point, and they break with an irregular fracture. They are usually tough, and sometimes fissile.

THIRTEENTH ORDINARY MEETING.

Wednesday, March 1st, 1865; Rear-Admiral Sir Edward Belcher in the chair.

The following candidates were proposed for election as members of the Society:—

Dibley, George, 72, Malden-road, Haverstock-hill, N.W.
Miles, Henry Thompson, 61, Strand, W.C.
Redman, Capt. Gabriel J., 6, Belsize-park, Hampstead, N.W.

The following candidates were balloted for and duly elected members of the Society:—

Reeves, Miss Sarah, Rectory Grove, Clapham, S.
Ridley, Rev. N. J., Hollington-house, Newbury.
Templeton, Archibald, 16, Argyll-road, Kensington, W.
Templeton, John, Budge-row-chambers, E.C.
Wallace, Hugh, Chemical Works, New-road, Battersea-park, S.

The Paper read was—

ON THE MEANS EMPLOYED IN TAKING FISH, ESPECIALLY WITH REFERENCE TO SUBMARINE ILLUMINATION.

BY F. W. CAMPIN, ESQ., BARRISTER-AT-LAW.

Although to the fisherman's calling there attaches a special feeling of interest, arising from the fact that some of the most notable of the first Apostles of Christianity were fishermen, and that we have in the Holy Scriptures narratives as to their labours in pursuit of their temporal calling, yet, whilst nearly every other industrial avocation has received attention and undergone modification, improvement, and advancement at the hands of our inventors and improvers of useful arts and trades, very little has ever been done to improve that of the fisherman; hence it seemed to me desirable to endeavour to direct public attention to the real state of the case, with the view of demonstrating that there are now available, means and appliances by which fishing operations can be rendered more easy, safer, less destructive to the breed of fish, and more productive than the methods and means heretofore employed.

It is true that in former times public attention was much directed to the promotion of this branch of industry; but this promotion took the form of Acts of Parliament, passed both in Scotland and in England, granting special immunities and supposed advantages to persons engaged in fisheries; and the herring fishery in particular was guaranteed much of that kind of encouragement which was then in vogue, viz., the institution of monopolies and special privileges, though it appears that a somewhat sounder measure was brought forward when, in 1677 (King Charles the Second's time), a new royal company was established in England, at the head of which were the Duke of York (afterwards James the Second), the Earl of Derby, and other influential persons. This company, after being favoured with considerable success, was brought to an end by an unforseen and untoward event. Most of its vessels, termed "busses," had it appears been built in Holland and manned with Dutchmen, and, on the pretence that these were Dutch vessels, the French, who were then at war with Holland, seized a number of them,

and this, it is said, ruined the company. Attempts were afterwards made to revive the undertaking, but they came to nothing, the death of the king intervening. Soon after the Revolution this business was again resumed, and efforts were made to interest the public at large in the scheme, which do not appear to have been successful, as we have no further accounts of the matter. Since that time other attempts have been made to encourage our sea fisheries, as in 1749, when an association (the "Society of the Free British Fishery") was formed, and bounties were granted to all vessels employed in the fisheries; but it was found in the end that the Dutch kept the market, although in 1757 the bounty was made up to 56s. per ton. However, little has ever been done in the right way, viz., organization and improvement of the art of fishing and of the methods and appliances used in the art, though it ought to be here recorded that the Society of Arts gave much attention to the subject of increasing the supply of fish, and that it was due to the exertions of the Society and the rewards it offered, that the fish-vans or fish-machines used (until the railway system became developed) for speedy transport of fish from the coast to London were adopted. Further endeavours were made by offers of prizes to stimulate the supply of large fish, such as turbot of a certain size.

Before leaving this part of the subject, it may not be amiss to briefly allude to the importance, in a national point of view, of maintaining and improving our fisheries, as to which it has been well observed, that since "Providence hath so eminently stored the coasts of Great Britain and Ireland with the most valuable fish, and since fisheries, if successful, become permanent nurseries for breeding expert seamen, it is not only due to the Supreme Being not to despise the wonderful plenty he hath afforded us by neglecting to extend this branch of commerce to the utmost, but it is a duty we owe to our country for its natural security, which depends upon the strength of our Royal Navy. No nation can have a navy where there is not a fund of business to breed and employ seamen without any expense to the public; and no trade is so well calculated for training up these useful members of society as fisheries." Since the repeal of the Navigation Laws this point has become of greater importance than ever.

The situation of the British coasts has been said to be one of the most advantageous in the world for catching fish; the Scottish islands, particularly those to the north and west, the most commodious for carrying on the fishing trade to perfection; for no countries in Europe can pretend to come up to Scotland and Ireland in the abundance of the finest fish with which their various creeks, bays, rivers, lakes, and coasts are replenished. Of these advantages the Scots seem indeed to have been most abundantly sensible, and their traffic in herrings is noticed in history as early as the ninth century.

The ordinary methods and appliances used for fishing purposes are, it seems, these:—

Cod-fish, as a rule, are taken by means of hand-lines but at the approach of autumn and in winter, when the fish are at the lowest depths seeking "ground bait," long lines have to be resorted to, which are furnished at intervals with hooks, upon which wilks are fixed for bait, and these are sunk by being "shot," or paid out," and after lying nearly a day or a night are "payed in," and the fish, if any, are taken off and put into the well of the smack. In fine weather small cod-fish are sometimes swept into the trawl net, the trawl beam, to which the net is fastened, mostly dragging the bottom, which is very injurious, destroying young fish and ova; in fact, so great is the evil of this, that it is now under investigation by the Royal Commission appointed to inquire and report as to British fisheries.

Mackerel are taken at one season with nets constructed on purpose, as, being then blind, any bait which may be lowered can be of little avail, as it cannot of course be seen by them; but after this blindness has left them hand lines are employed.

Whitings are taken by hand-lines baited with mackerel, from April till August. They are taken by trawlers in great numbers; but, when caught by trawling, their market value is much lessened, by reason of their scales being rubbed and the elegance of the fish destroyed; whereas, by the ordinary line-fishing they are not damaged, and they fetch a high price in consequence.

Haddocks are taken by lines with mussels for bait, and are also taken by trawling, but are then, as is the case with whitings, very much lessened in value.

Gurnets are generally taken by lines, and frequently while fishing for whitings.

Skate are very frequently taken by the hand-lines, the same bait being used as for cod. They are also at times swept into the trawler's nets; many are taken on the Doggerbank fishing grounds by the long lines.

Artificial baits are sometimes used, and are made of vulcanised india rubber—hollow—and in the form of a fish. They have been tried in several instances and found to be highly attractive. They are made by W. Warne and Co., of Tottenham, and are, for the following reasons, very economical: Being exceedingly tough, they are not destroyed by the teeth of the fish; entering crosswise, they are not swallowed, and are usable a second time; they are at all times ready for putting into the hooks, and can easily be taken off when out of use; wilks, being the chief bait for cod-fishing, cannot always be obtained—smacks often lose days waiting the arrival of wilk-boats, and wilks once used are mostly destroyed; besides all which, many are found to be dead when wanted for use; and such is the extraordinary facility these fish (cod) have for scenting dead wilks, that they instantly reject a "dead 'un." Taking all things into view, the artificial baits are, perhaps, more economical and advantageou than any other kind of bait.

It is a well-known fact that fish are to be attracted by light—a fact which was not unknown to the ancients; and it has been the constant practice of the Chinese, handed down from remote ages, to use apparatus for catching fish, consisting, as I understand, of a board or frame, having candles or other means of lighting placing thereon, with a frame or net hinged thereto, which is floated on the surface of the water, and when the fish have been attracted by the light to the frame or net it is thrown up on the hinges, thus taking the fish. Surface lights have also been in use for catching salmon, pilchards, and other fish. An attempt to render a surface light commercially available was made by a public company about the year 1826. It was not, however, persevered in, and I am not aware that its operations were attended with any degree of success.

In the year 1862, Mr. Henry Richardson Fanshawe obtained a patent for "Improvements in the mode and means for fishing in seas, rivers, and other waters;" and in the specification of his patent he thus describes his invention:—

"My improvements consist in the employment of a submerged or subaqueous light, for the purpose of alluring or decoying fish, thereby facilitating their capture, the light I employ being derived from electricity or from the ignition of oil or gas, or I may employ phosphorised oil or other luminous fluid or any means for producing or maintaining a light under or below the surface of the water; or I may obtain a sufficient volume of light for my purpose by reflecting light from above upon submerged reflectors."

Mr. Fanshawe further states that he uses "arrangements of globe, lantern, or reflectors, the decoy light or reflector being placed or disposed in such a manner at the required depth that the fish are attracted thereto by the light. The illuminating apparatus may be lowered to the required depth by any mechanical arrangement which will answer the purpose desired, but he constructs or fits boats with a well or wells at or near their centres, for the purpose of more conveniently superintending the working or adjustment of the decoy arrangement, and of seeing

when a sufficient number of fish are collected, so that the boat may be removed for the purpose of closing the net or nets. When the electric light is employed, the lantern may be sunk before ignition, and the light extinguished before its withdrawal."

After describing in detail the invention, Mr. Fanshawe's specification states:—

"In working the boat with the lantern and its lowering apparatus, I place it in the position assigned by previous arrangement with the fishermen, and having unbolted the top of the lantern and ignited the lamp, re-bolted the top on, and connected the two lengths of flexible tubing required, one to the inlet and one to the outlet pipe, I lower the lantern, by means of a windlass and chain, to the desired depth; this, in many cases, will be found to be about half the depth from the surface to the bottom. It will be obvious that tubes must be of such a length that, at all depths to which the lantern may be lowered, their ends may be above the surface of the water, and I prefer to maintain them in a position about eight feet above the surface of the water, bending their upper ends downwards to prevent water and spray from entering, and the wind from disturbing the current of air in the apparatus, as it may otherwise cause too great pressure on the ingress, and impede the escape of the bad air from the outlet pipe. In some cases the light may be required to be stationary, in others it may be found advantageous to move slowly in any one particular direction as may be previously agreed upon. In working or manœuvring the well boat and lantern, much must depend upon the nature of the bottom, the depth, and also the habits of the particular fish sought after, which will be best known by experienced fishermen. When a sufficient time has elapsed for the fish to congregate in the locality of the light, the boat can (after drawing up the lantern and air tubes) be moved, in order to enable the fishermen to carry out their operations.

"In line fishing similar operations are carried out, always taking care that the baited hooks are placed in a horizontal, or nearly horizontal, line, and to employ the reflector lanterns, as hereinbefore mentioned, so as to throw the light in the direction of the line or lines.

"In some cases, where it may be found desirable to employ more than one lantern, a buoy or buoys should be used to sustain the lanterns, and the tubes supported by a frame of wood or metal fixed upon the said buoy, the ends of the tubes being carried about eight feet above the buoy, and bent downwards, as in the case before mentioned. To assist in maintaining the steadiness of the light, which, when in use as a decoy, is important, I employ a strap or band of vulcanized india rubber between the end of the windlass and the ring on the handle of the lantern. This strap or band must be of sufficient strength and length to prevent, as far as possible, the communication of the undulating motion of the boat or buoy to the lantern by the extension (due to its elasticity) of the said strap or band. I protect the said strap or band by placing a chain or chains, of greater length than the said strap or band, in such manner that the chain or chains will hang loose, and upon any sudden snatch, or motion on the surface of the water, the chain or chains will limit the extension of the strap or band, and prevent its breakage. In moderately-smooth waters the use of this strap or band will not be necessitated.

"In all cases where india-rubber tube is mentioned in this specification, it should be understood that it must be vulcanized india rubber tube, and must be of the description known as suction tube; and in all cases where glass is mentioned, the glass may be either plain or coloured, in any way that may be found to give the tone of light best suited for the purposes herein described, and for the particular kind of fish sought after.

"In some cases I employ a mirror or polished surface to act as a reflector of the sun's rays, or at night to reflect those of the moon, or of lamps or lights placed superficially above the water; and by means of cords or chains hereinafter mentioned, I regulate the angular position of the upper rays of light, whether of natural or of artificial light. It is found that in very clear water a lantern, similar to that termed a bull's-eye lantern, produces from the side of the boat or vessel a strong reflected ray of light upon the submerged reflector, but the plan of employing the reflectors answers well in very clear waters only. When the bull's-eye lantern is employed, the reflector therein should be placed higher, and at a more acute angle than is the case in the common bull's eye lamp, and the lens should be placed at the corresponding angle, so that there may be no necessity to interfere with the upright position of the wick or lamp. The reflecting submerged surface must be weighted, and have cords or chains as, hereinbefore-mentioned, leading up to a boat, and fastened to the gunwale, or to pegs or hooks."

Mr. Fanshawe made the first sea trial of his invention in May, 1864, in Rye-bay, on the fishing ground known as the Falls, and was very successful in decoying whitings and mackerel to the bait. As in most first trials, some difficulties presented themselves. From there being too little weight to sink the lantern and to keep it perpendicular in the under-currents, and also in consequence of the prevailing E. and N.E. winds, not so much success attended these efforts as was expected. However, a trial was made in August, off the coast of Scarborough, where, upon one occasion, several gentlemen of that town accompanied the *Hewitt* smack to witness the effects of the Patent Subaqueous Light, and were, as they expressed, equally surprised and delighted. A report was published in one of the papers of that town. Many of these gentlemen were provided with their own lines and hooks, and took large quantities of whitings.

The appearance of the sea during this trial has been described as very splendid—the reflection from the sunken light throwing up the bluish green tinge of the water from the valley to the crest of each wave. Even the sails and cordage of the vessel were thus lighted up with the resemblance of a ship afloat on a sea of gold. The silvery fish darting about, and ever and anon ascending nearly to the surface of the illuminated water, presented the appearance of dots of polished silver in a sea of gold and azure.

In the five voyages made by the above-named vessel, in which the light was placed, many whitings were taken to market. In fact, the experiment was deemed a most successful one.

In September, 1864, the smack *Hewitt* again left, but this time for the North Sea fishery, to take cod-fish by the aid of the subaqueous illuminator, and was very successful upon several occasions. She was accompanied by other vessels, which also were successful in taking cod-fish in the illuminated water, the largest quantities of fish being found at the verge of the light, or rather in the shadow, as many as thirteen score having been taken at one "take" by a smack so placed. As a rule the largest and finest fish are taken nearest to the light, the smaller and more timid fish being in the shade.

Oil lighting material has so far been employed, and there is no doubt that eight or ten fishing vessels could be worked round one light, especially if one of greater intensity—such as the electric light—were adopted.

Although Mr. Fanshawe's patents, both for Great Britain and for France, for the application of light to fishing purposes, were secured prior to the patent of Iodocius, whose name has been before the public in connection with this subject, he has most successfully used the electric light on the French coast, and under, it is said, the especial sanction of the French Emperor, has captured large quantities of fish, showing at once the certainty of the principle adopted, namely, that fish are unmistakeably drawn from the ground, at sea or in rivers, by the decoying action of light. The great object gained by the subaqueous illuminator, is that we descend so near to the fish as to induce them to leave and to take the bait, which is visible, whereas surface lights, when employed,

are only useful as decoys in isolated cases, and then only to a very inconsiderable depth.

As an instance of the magical effects of light upon fish, it is stated upon reliable authority that in cases where the diving bell has been employed in vicinities where fish are to be found, the water immediately around has been seen teeming with them.

The subaqueous light was tried in fresh water in the River Lea, at Tottenham Mills, and was visited by very many persons. The attractive properties were at once manifest, g eatly to the admiration of the many people present. These displays took place during a period of several months, and previously to the display of the principle in salt water.

Mr. Fanshawe proposes to employ the light in fresh water for salmon-taking.

Mr. Fanshawe's system is said to be very advantageous for the following reasons:—

1. As economising labour on the fishing grounds.

2. Shortening the time now occupied in taking any given number of fish.

3. In the quantity of bait used, and in the necessary outlay for lines and gear—"long lines" being superseded —"hand lines" only being required in line fishing.

4. Increased safety for human life, the work being confined to the decks of the vessels.

5. In the conservation of the young fish, too small for market, and also of the ova; there being in ordinary trawling (numerically) more fish destroyed by the present trawler's "beam," and the necessarily great pressure of the "long lines," than are caught. By the patent decoy light this constant process of destruction of newly hatched and of unhatched fish is entirely obviated, as only fish worth taking rise from the bottom to the decoy light, and are there taken by the baited hooks; or, as in the case of trawling, within the range of the usual nets; trawling as usually practised being superseded.

6. Increase of fish supply. Independently of the advantages shown by the employment of this patent plan as regards the extra quantity of fish caught through its aid, there are many localities inaccessible to the ordinary modes, and whence fish may be decoyed to more favourable positions for capture; besides which, immense quantities of non-edible fish are attracted, all of which are valuable, either as manure, or as oil producing material; and these fishes are voracious, and constantly feeding upon the edible fish, so that two ends are gained by their removal.

In concluding this, my imperfect essay to handle a subject doubtless second to none in national and commercial importance, I may perhaps be allowed to state that I have abstained from treating of the taking of fish by angling, as that is a method resorted to more as a sport or pastime than as a matter of trade, this latter being as it appeared to me what needed consideration. Further, it perhaps may be permitted to me to state that I have practically no acquaintance with fishing operations, all the statements that I have made on that head being derived from information obtained from Mr. Fanshawe and others; and in alluding to that gentleman, I hope I may be allowed to trespass further on your time, by referring to an incidental topic—one as I conceive of the very greatest importance—it is this:—that should Mr. Fanshawe's invention be found to be an improvement of public and commercial importance—it is without question one by which he would have no chance of obtaining any pecuniary remuneration, unless it were by interesting capitalists in the formation of a company (which I understand is his intention), securing them in the possession of the exclusive rights granted by the patents, or by the means of royalty payments for licenses under the patents; in other words, without the patent laws, Mr. Fanshawe would have no chance of reward.

DISCUSSION.

Mr. Stovin remarked that during the reading of the paper the question had been asked when this patent was taken out, and no doubt the length of time which had elapsed since the filing of the specification (1862) might, if unexplained, tend to throw some discredit upon the invention. The delay in the commencement of the operations was easily accounted for, In the first place, there were great difficulties attending the organisation of a system to carry this invention into practice, a great many experiments had to be tried, and various kinds of apparatus had to be constructed before that which would thoroughly answer the purpose was arrived at. Then again, Mr. Fanshawe himself was so much occupied with other business that he could not give his entire attention to this matter, and therefore it had been put off from time to time, and though experiments had been tried at intervals, they had not been carried on in such a manner as to attract public attention to the invention. From what he had seen of it himself, he fully believed it was calculated to confer great benefits on the community in the way of increasing the supply of fish to the markets, and cheapening that which might be made a staple article of food, so as to bring it within the means of the poorer classes. He believed that when a company had been formed to carry this invention into practical operation, the results would be of a highly satisfactory character; but, as far as the experiments had gone hitherto, they did not afford a fair criterion on which to form a judgment as to the real merits of the invention.

Dr. Bachhoffner (who had inquired the date of the specification) said he asked the question simply from curiosity, inasmuch as he had not heard of it before. There were many points in the system brought forward which struck him as ingenious, but they all knew that the plan of catching fish by alluring them with light was no novelty, though the light was most commonly employed above instead of below the surface of the water. At the same time he must be allowed, on the part of the finny tribes, to repudiate the idea of their being attracted by being enabled to see, through the means of this submerged light, the particular nature of the bait which was offered to them. For his own part he did not believe that fish were such epicures, although, like the moths, they might be attracted by a light to their own destruction. He apprehended that the invention was also applicable to deep sea fishing; and if that were so, he imagined that some means would be required for forcing air down the flexible tube in order to support combustion. The use of submarine light for facilitating operations beneath the surface of the sea was no novelty. At the time of the operations for blowing up the wreck of the *Royal George*, at Spithead, the late Sir Charles Pasley complained of the difficulty of carrying on the works when the water was in a thick and muddy state, when he (Dr. Bachhoffner) suggested that if the divers were supplied with two pieces of artificial graphite in connection with the wires used for firing the charges of gunpowder by electricity, the means of obtaining a submarine light would be furnished. The suggestion was acted upon, and the result was satisfactory, but he did not remember whether it was in that instance that the fish flocked round the divers in such extraordinary numbers. He had heard of an invention for introducing the electric light below the water in a vessel hermetically sealed, but he believed it was only intended for the purposes of submarine foundation works.

Mr. S. Redgrave confirmed the remarks made as to the antiquity of the practice of decoying fish by means of lights on the surface of the water. Mention was made in an old work of a lady at Twickenham, who was annoyed by the disturbances made at night by the salmon fishers in the Thames; and he had in his possession a drawing, eighty years old, representing salmon-fishing by torch-light in the river Tamar.

Mr. Bishop mentioned that surface lights in fishing for salmon and other fish had been in use for many centuries on the coasts of Norway, more particularly on the Naze and at Christiansand.

Mr. Varley remarked, that many years ago Admiral Coffin introduced a method of catching fish in large quantities by means of glittering artificial bait, a plan which was particularly successful in mackerel fishing. For such a process he thought the proposed submerged light would be extremely applicable.

Mr. De Mornay said, in almost all parts of the world the practice of fishing with lights on the surface of the water obtained. In parts of America large quantities of fish were taken by attracting them in this manner, and then feeding them with a preparation made from the bark of a species of *mangue* tree, the intoxicating effects of which caused the fish to float helplessly on the surface, when they were taken in large numbers. In a short time they recovered, and no pernicious effects were produced in the fish by this drugging, so as to depreciate them as food.

The Chairman said, as an old fisherman of sixty years' standing, he might be able to tell the meeting a little about the subject under discussion. In the first place, with reference to the remarks in the early part of the paper, that the fishing trade of this country afforded a means of recruiting the naval service, he might say, after a very long association with sailors in Her Majesty's service, that he had very rarely found a fisherman in the navy; and he supposed that was a great deal owing to fishermen being exempted from impressment during the war. It was, however, often the case that old seamen who had served in the navy fixed themselves along shore and became fishermen, but these were worn-out men, and would, of course, be unfit for the service. The only really able fishermen were those in the North Sea, and they were too well paid for their work to enter the navy. As a naval officer, having to select a ship's crew, he would, as a rule, refuse fishermen; and he knew that was also, to a great extent, the feeling of French naval officers. On one occasion he was informed by a French admiral that, being forced suddenly to put to sea, he had been compelled to take a crew mainly composed of fishermen. The result was that he was obliged to reef topsails, and for many days dared not make sail, because his crew of fishermen were all sea-sick and unable to work. During the French war two fine ships sent to sea were captured, within a few miles of the French coast, by two small frigates—an easy conquest, in consequence of a great portion of their crews being sea-sick and unable to fight. The Newfoundland men were great fishermen, but their occupation there was merely to sit within a circular space, with a barrier to protect them from the water, and to clean and split fish, an employment which did not in any way fit them for service on board ship. In the days of his (the Chairman's) boyhood he was in the habit of running away from his home, and spending a good deal of time with the Mic-mac Indians, learning their secrets in fishing. One of the principal methods employed by semi-civilized tribes, as well as by savages, had always been the use of the flambeau at night, and at the present time that mode of fishing was a favourite amusement amongst the ladies of Nova Scotia, the prey being chiefly lobsters, which, being attracted by the light, were taken by prongs into the boat. He had fished in every part of the world, and was bound to say he could not give the preference to our English coasts in respect of the quantity of fish to be taken. It was in Newfoundland, on the coasts of Barbary, and in Southern Africa, eastward of the Cape of Good Hope, that the best fishing was to be found. There was no necessity for bait there; but with little pieces of bright metal, with hooks attached, fish were pulled up as fast as the line could be put in, by what was known in this country as "foul-hooking." On the west coast of Newfoundland a cutter, 25 feet long, would be filled with fish in two hours with ten lines. In the deep-water fisheries of that country lines of 70 fathoms in length were used, and the hooks were baited with the bright metal baits, until the month of June, when the caplins—small fish resembling the smelt—come in season, and then these were used. A great bait for fish in most parts of the world was the squid, or cuttle-fish. With respect to the delicate taste of fish in their bait, he had not much faith in this, for it was a common practice, after having caught one fish, to take what he had in his stomach for bait, and thus to catch a great many more. It was a very curious fact with regard to mackerel, that in some places the fish did not open their eyes till about the 22nd May, and in other places, such as on the coast of Ushant, in France, they did not bite till the first week in June. The bait most used for taking this fish on our own coast and in the North Sea was the lug-worm. Skate were principally captured with the trawl, but they were occasionally taken by bait in the North Sea. The trawl had of late years, from some cause, got into sad disgrace, and was now on its trial before the House of Commons; but he believed this was mainly due to a quarrel between the fishermen on the north-east coast and the Torbay fishermen, some of whom came to the north-east coast, and understanding the proper use of the trawl better than their brethren there, were consequently more successful in their takes of fish, and hence jealousy had arisen between them. For his own part, he thought the trawl, when properly used, was not open to the objections made against it. On the western coasts of South America the half-caste Spaniards were very successful in fishing with flambeaux, made of long, thin strips of a red resinous pine, bound together in bundles about as thick as the wrist. The boat, with the flambeau projecting over its bow, was kept in gentle motion, and the fish being attracted to the surface by the light of the flambeau, were readily speared in great numbers. In China and the West Indies fishing with lights on the surface was carried on to a great extent, but in this instance nets were used. He had seen fish go to the bait in 32 fathoms water. By throwing a little oil on the water a perfectly glassy surface was obtained, and it was possible to see very clearly to a great depth; and this was particularly the case in some of the lakes of Switzerland. He would now say a word or two with regard to the question of the production, by this invention, or by any other means, of an increased supply of fish as a food for the poorer classes. There were already large takes of fish, such as herrings and mackerel, at Tenby, which (although there was railway communication) it was not thought worth while to send to London or elsewhere for consumption by the people, and if this was so, what was the use of endeavouring to obtain still larger quantities? While the fish was disposed of on the coast at nominal prices, and used for manure, all kinds of fish remained very dear in London, and beyond the reach of the poorer classes. Our great want, therefore, was, that the fishermen should be compelled not to throw away large supplies of food when there was a glut of it in any particular locality, but that they should be forced to send it to market, where there was a great demand for it. It was a well-known fact that, years ago, in order to keep up the price of fish in the London market, the fishmongers stopped the smacks at the mouth of the Thames, and made them throw their cargoes overboard. With regard to the powers of Mr. Fanshawe's patent, it was well known that its powers did not extend more than three miles from the coast of Great Britain. Reverting to the question of the alleged destruction of small fry and ova by the trawling beam, the chairman remarked that he felt quite sure the objection to the trawl arose entirely from ignorance of the proper method of using it, and not from any fault in the apparatus itself. No fisherman, he said, who understood his business, would attempt to draw his trawl against the tide, for he would catch no fish. The boat must go with the tide, but a little faster, and then the trawling beam would rise up some little distance from the bottom, and the best fish would be caught. With regard to the alleged destruction of spawn by the trawl, no spawn was found in deep water. It was a fact well-known to naturalists that the spawning

of all descriptions of fish took place in the shallow water along the shores and creeks, where there was no trawling. The outcry against the trawl on the ground of the destruction of ova was not, therefore, justified by facts. The chairman concluded by proposing a vote of thanks to Mr. Campin for his paper.

The vote of thanks having been passed,

Mr. Campin acknowledged the compliment, and said if he had known that his efforts would have been subjected to the criticism of so experienced an authority as Sir E. Belcher, he should have hesitated in bringing this subject forward, having himself no claims to attention as a practical fisherman. Looking to the project of Mr. Fanshawe he thought, on the whole, some beneficial results in regard to an increased supply of fish as an article of food might be expected from its application. Judging from the remarks of Mr. Stovin, he thought that gentleman was too diffident with regard to the experiments already made, inasmuch as Mr. Fanshawe had reported that his apparatus had been the means of attracting very large quantities of fish. Whether it would be commercially successful or not was a question he would not now enter upon. With respect to the point raised by Dr. Bachhoffner as to the supply of air necessary for combustion at a great depth under water, he apprehended that was a mechanical matter which could easily be provided for, and he believed Mr. Fanshawe contemplated the use of some air pumping apparatus for great depths.

Mr. Hawes said, as Chairman of the Council, he would venture to take the somewhat unusual course of giving the thanks of the Council, and he was sure he might add those of the meeting, to the chairman for having, in so able and entertaining a manner, communicated to them the results of his experience on this subject, extending over a great number of years.

Proceedings of Institutions.

Bacup Mechanics' Institution.—The Report of the Directors, presented at the twenty-sixth annual soirée, January 3rd, 1865, records the continuance of the prosperity of the Institution. In their efforts to promote the cause of education, the directors have received abundant help from friends of every religious denomination, and a spirit of kindly sympathy has been displayed by the members. The finances of the Institution are in a healthy state. The receipts have been £399 15s. 6d., the balance in the treasurer's hands at the end of the financial year being £12 10s. 1½d. In the first quarter of the year there were on the books 275 members; second ditto, 225; third ditto, 200; fourth, 287, being an average of 246 members per quarter. The directors regret that many of the members are in the habit of discontinuing their subscriptions during the summer quarters. The effect of this narrow policy is to cripple the funds of the Institution to a very considerable extent. During the year about 90 volumes have been added to the library. An increase over the previous year has taken place during the last twelvemonths in the issue of volumes, the number being 7,038, or an average of 41 volumes for every member whose name is on the librarian's register. The news and reading-room is much frequented. The receipts of the Wednesday evening lectures, which terminated in March last, were a little short of defraying the expenses of the course. The third series of lectures and entertainments commenced in October last. Amongst them may be mentioned the Rev. Arthur Mursell, of Manchester, "Wanderings at Waterloo;" Mr. Robert Dodwell, C.E., of Manchester, lecture entertainment, entitled, "Two Hours in a Telegraph Office," illustrated by apparatus, &c.; Mr. Samuel Wimpenny, of Holmfirth, "The Life and Travels of Dr. Livingstone," illustrated; Messrs. Ellis and Cavanah, of the Manchester Shakesperian Society, "An Elocutionary Entertainment;" Mr. W. A. Abrams, of Blackburn, "The Literature of the Lakes;" and Mr. T. Hastings Ingham, of Skipton, "The Philosophy of Shakespeare." A manuscript magazine, consisting chiefly of original contributions by members and their friends, was commenced in April, 1864, and has been successfully continued monthly to the present time. It has proved valuable as a treasury of institutional and local information. The character of the evening schools has, during the last twelve months, been fully maintained. The increase in attendance at the evening classes has been considerable. In efficiency, as tested by the Local, Society of Arts, Science and Art, East Lancashire, and Lancashire and Cheshire Union Examinations, the School has made decided progress. It is a source of regret that in some of these examinations the candidates are almost entirely from the younger members of the classes, while the older ones make no attempt to compete in them. The establishment of the science classes, in which chemistry and physiology are taught, has been attended with the best results. The directors regret that the female classes are not so numerously attended as they deserve to be, seeing that they offer a good opportunity for young women to acquire a serviceable education at an inexpensive rate. The day school has been well attended during the twelve months, but as work has been scarce and unremunerative, many parents have not been able to pay the full fees. The number of children on the day school book is 232, and on the night school book 119, making a total under tuition at the Institution of 351.

Farnham Young Men's Association.—At the recent annual general meeting of the members, the committee for 1865 were elected. From the balance-sheet it appeared that the expenditure for last year was £134 2s. 7d., the balance due to the treasurer being £29 2s. Several important alterations were made in the rules of the Association. Since this meeting the debt of the Association has been kindly paid off by the Bishop of Winchester, President.

DIGEST OF PARLIAMENTARY PAPERS.

Notice having been given by Mr. William Ewart, in the House of Commons, "To call the attention of the Government to the public advantage which would result and the saving which would accrue from the publication of an abridgment or digest, to be issued from time to time, of all the Parliamentary Blue Books, and similar documents, on the same plan as that of the 'Statistical Abstract' issued by the Board of Trade since the year 1854" (Friday, 10th March), the following statement of facts on this subject may not be uninteresting:—1. The Parliamentary Papers consist of (1.) Votes and Proceedings of both Houses of Parliament, Journals, &c.; (2.) Bills as presented in both Houses, and in their various stages; (3.) Papers presented by command, viz., Correspondence on Diplomatic Subjects—Reports of Permanent Commissions and Public Departments, such as Revenue Boards, Poor-law, Judicial Statistics, &c.—Reports of Temporary Commissions, such as Patent Law, State of Education, &c.; (4.) Returns ordered by both Houses; (5.) Reports of Committees of both Houses; (6.) Acts of Parliament. 2. On an average, there are upwards of 1,000 documents published yearly, the greater part of which are in folio, and altogether they extend over not less than 50,000 pages per annum. The cost of printing papers for both Houses of Parliament was given in 1864 at £67,500, independent of the large amount expended in printing, &c., for the several departments of Government, amounting in all to upwards of £300,000. 3. In the publication of such documents there is necessarily, and in many cases unnecessarily, a constant repetition of facts, a great diffusion of details, and an evident want of system.* 4. Such papers are not much read by the

* In illustration of this fact it was shown in evidence before the Committee of the House of Commons in 1862, by Professor

members themselves, for want of time during the Session to wade through them; nor are they read by the public, for want of facilities for getting at them. 5. Setting aside the sale of these documents singly at the Parliamentary Paper Offices, which is comparatively very small, the public at large have no means of consulting such Parliamentary Papers in a collective form, since, on account of their bulk and expensiveness, no private gentleman and no public institution can conveniently afford the space required to keep them. Apart from the British Museum and other National Libraries (three or four in number), very few other libraries possess a full collection of all Parliamentary Papers. 6. Hence the greater bulk of such Parliamentary Papers, which would be well calculated to diffuse solid and valuable information on all political, financial, and economic subjects, is sold and used up as waste paper. 7. The Committee of the House of Commons on printed papers, of 1835, originated by Mr. Joseph Hume, in their report, p. 24, recommended that the printing committee should have power to classify such papers, and to direct the manner and form of printing the same, either *in extenso*, or by way of abstract, as may be most calculated to convey to the House the requisite information. 8. In 1852, the Society of Arts, and Mechanics' and Literary Institutions throughout the country, petitioned Parliament for the gratuitous distribution of many of these reports, alleging that such a diffusion of useful knowledge would be attended with very great public advantage; and on the motion of Mr. Tufnell a Committee of the House of Commons was appointed to inquire into the expediency of distributing *gratis*, under certain regulations, a selection from the reports and returns of the House of Commons among Literary, Scientific, and Mechanics' Institutions throughout the United Kingdom. The committee recommended that on the receipt of any applications certain reports or papers should be granted. But it does not appear that the resolutions were at any time carried out, from the difficulty of making any selection, and from the want of accommodation in such institutions for such a mass of heavy volumes. 9. In 1854 the Board of Trade began to issue the statistical abstract, comprising a collection of all the facts recorded in all the public documents for the previous fifteen years, and this has been eminently successful, in consequence of the easy reference it affords for a considerable amount of varied information hitherto unattainable except from numerous sources; but the statistical abstract is confined to economical facts, and gives none of the circumstances which give rise to such facts. It only culls out the figures, which, though instructive in themselves, do not sufficiently indicate all the lessons they are intended to teach. 10. Attempts were made to supply this want in 1856 by Professor Leone Levi, in his "Annals of British Legislation," being a summary or digest of all public accounts, papers, reports, &c., of both Houses of Parliament, classified under the following eight series, each comprising all the papers published on the respective subjects:—Series A, Finance, Commerce, and Agriculture; B, Diplomacy and War; C, Ecclesiastical Affairs and Education; D, Railway Shipping, and Postal Communication; E. Law, Justice, and Crime; F. British India, Colonies, and Dependencies; G. Population, Municipal and Parliamentary; H. Health and Miscellaneous. 11. The work is published by Messrs. Smith, Elder, and Co., in monthly parts, forming two volumes a year of about 500 pages octavo each, and gives within this limited compass, and for two guineas per annum, all that is most valuable or needful to be preserved for reference, as regards the general reader, out of the large number of volumes published every Session. 12. The "Annals of British Legislation" have now been in existence for seven years, and fourteen volumes of the same have already been published; but whilst its utility has been fully recognised by many of our most eminent statesmen, experience has shown that a work of this kind cannot be sustained as a commercial operation, not possessing those advantages which are enjoyed by works issued by public authority. 13. Having regard to the success of the "Statistical Abstract," and to the appreciation which has attended even the private enterprise above described, it cannot be doubted that the publication of a Digest of Parliamentary Documents by the Board of Trade would be attended with great benefit; not only by the diffusion and preservation of most valuable information now practically buried and lost, but by the direct saving of a large sum of money—since it would render unnecessary the publication of many copies of papers now printed by both Houses of Parliament, and would greatly extend the circulation of those of which the publication is necessary.

Leone Levi, that the state of the finances is given in the quarterly accounts of the revenue, the finance accounts, the statistical abstract, the miscellaneous statistics, the reports of the respective boards, and Mr. Williams's returns; the Customs Revenue being, moreover, given in the Board of Trade accounts, both monthly and annually. The reports of committees generally contain evidence repeating again and again the same facts and opinions. The reports of the Civil Service commissioners give all the examination papers. The treaties with foreign powers are published in English and in the languages of the countries with which they are concluded. As to bulk, it is quite usual to publish folio volumes of 800 pages. The report on the Endowed Schools (Ireland) comprised 1,884 pages.

Fine Arts.

PARIS SCHOOL OF BEAUX-ARTS.—The Council of the school has fixed the annual competition and exhibition of the works of the students for the grand prize of Rome a month earlier than usual this year. The decisions are to be made on the 11th of August, and, for the first time, the exhibitions of the works in architecture, painting, and sculpture will take place at the same time. In addition to this annual competition for the privilege of studying at Rome—the Roman scholarship—there are quarterly exhibitions in the school, when honorary prizes are awarded to the pupils; but another kind of competition has just been set on foot, which deserves attention from its novelty and liberality, and which, it is said, promises to work well. The authorities have offered a certain number of silver medals to be awarded by the pupils amongst themselves once a year. The method adopted is as follows:—Each professor selects from amongst the works of his own pupils those which he deems the best. The pupils of each of these schools then elect five out of their own body, and the works of each school are judged by the delegates from its rivals. The pupils in painting of M. Cabanel and of M. Pils obtained in each case a first, second, and third-class prize, while those of M. Gérôme received first and second, but no third prize. In sculpture, M. Durant's school obtained all three; M. Duret's second and third-class prizes only; and M. Jouffroy's one first-class medal. The three architectural schools each earned prizes in all three classes. This is certainly a novel experiment, and of course highly gratifying to the pupils themselves, who are thus formed into a kind of mutual jury.

M. HEBERT, a very charming painter, is said to have been appointed to succeed M. Schnetz as director of the French Academy at Rome.

SCULPTURE FOUND IN CANDIA.—In digging foundations for a mosque near the village of Hicropetros, in the island of Candia, on the site of the ruins of some ancient buildings, three statues have been brought to light. One of these is of colossal size, and represents a warrior; it seems to be unfinished, but admirably executed. On the cuirass are various emblems, amongst which, and in the centre, is a figure of a man standing by two winged creatures who are placing a wreath on a youth's head. The right hand of the statue is missing. Another of these works is supposed to represent Oceana, and has a small stag crouching at the feet. The third is the statue of a man, without any special attributes.

Stained Glass.—The works at Metz are in full activity, and the Belgian journal of the beaux-arts speaks very highly of a window just completed for the cathedral of that town. The subject is the ascension of Saint Barbe and Saint Catherine, supported by archangels, the figures being all larger than life. M. Maréchel, the artist, has availed himself of all the means calculated to give richness and variety to his work, such, for instance, as the use of double glass in parts, and the superposing of one shade or tint over another. The style is that of the fifteenth century, the Augustan age of painted glass.

Public Monuments in France.—A competition has just been opened in Paris for a statue of Marshal Massena, to be erected at Nice, the place of his birth. It is to consist of a bronze statue, about ten feet high, to stand on a pedestal with bas-reliefs. The judges are to be appointed by the administration of Fine Arts. The sum of 25,000 francs is to indemnify the fortunate artist for the whole of his work, statue, bas-reliefs, casting, conveyance, and erection. The pedestal is to be supplied by the authorities, and it is announced that 10,000 francs will be expended upon its ornamentation irrespective of the masonry itself. The sums of 1,000 francs and 500 francs are to be awarded to the second and third designs in the order of merit.—A monumental statue of the famous astronomer Arago, lately modelled by the sculptor Oliva, has just been cast in bronze, and is to be erected at Estagel in the department of the Pyrénées-Orientales, where the illustrious savant was born.—The Municipal Council of Madrid has commissioned the sculptor Medina to execute a statue of the painter Velasquez, which is intended to be appropriately placed in front of the public Gallery of Painting in that city, as a companion to that of Murillo recently erected there.

Forthcoming Publications.

The Applications of Geology to the Arts and Manufactures. Foolscap 8vo., cloth, illustrated, price 4s. By Professor D. T. Ansted, M.A., F.R.S. (*Robert Hardwicke, Piccadilly.*)—This work will consist of the course of six Cantor lectures now in course of delivery before the Society, of which merely abstracts are published in the *Journal*. It will appear as soon as the course is concluded.

Correspondence.

CANTOR LECTURES.—WATER SUPPLY.

Sir,—In the Cantor lecture delivered on the 13th inst., of which an abstract appears in your *Journal* of the 17th inst., on "Springs and Water Supply," I observe that the learned lecturer, Prof. Ansted, is reported to have said—"The two rocks that yield the largest quantity of water are chalk and soft sandstone, and in neither of these cases can more than a million gallons per day be expected from a single well. To yield this maximum such wells must be more than a mile asunder." Many popular delusions exist on the subject of wells, and as the above statement, circulated in your *Journal* on such authority, is likely to further mislead the public if left unnoticed, I am sure the professor and your readers will be glad to know that very many wells have been sunk, both in the chalk and red sandstone formations, that readily yield much larger quantities than one million gallons per day, even when situated, as sometimes happens, only a few yards distant from other wells. By way of practical illustration, I may mention the following wells yielding more than one million gallons of water per day, sunk in the chalk, the water being used for domestic consumption:—

Hull, Yorkshire.—A well with bore holes sunk in chalk, near the town of Hull, yields three and a-half to four million gallons of water per day.

Croydon, Surrey.—Two wells with bore holes in chalk, distant only twenty yards apart, yield one and a-half million gallons per day each, or three million gallons collectively.

Brighton, Sussex.—One well, with adits connected with same, sunk in chalk, yields two and a-half to three million gallons per day.

Amwell, Herts.—The Amwell Hill well, sunk in chalk, belonging to the New River Company, yields two and a-half million gallons per day.

Deptford, Kent.—Two wells, situated not fifty yards asunder, yield about five million gallons per day collectively.

The following wells, sunk in new red sandstone, yield more than one million gallons per day:—

Liverpool, Lancashire.—Green-lane well, sunk in new red sandstone, yields more than three and a-quarter million gallons per day.

Birkenhead, Cheshire.—Well in new red sandstone, yields two million gallons per day.

Pendleton, near Manchester, Lancashire.—Well in new red sandstone and permian, found to yield more than four million gallons per day; not in constant use.

I may add, practical experience has taught me that in suitable situations, by the aid of improved modern appliances and machinery, wells and bore holes may now be sunk, at a very moderate cost, to yield very much larger quantities of water than was at one time possible.

I am, &c., Samuel Collett Homersham.

19, Buckingham-street, Adelphi, London, W.C., February 28, 1865.

The Municipal Organization of Paris.—Sir,—There is a slight inaccuracy in the report of the remarks I made at the meeting of the Society on the 22nd ult. I am reported to have said, "With respect to the great improvements carried out in Paris, they had been told that a taxation of £3 15s. per head of the population had been the result; whereas the whole rates in respect of the main drainage and improvements of London did not amount to more than 9d. in the pound, or about 10s. per head of the population." What I stated was, that the annual sum raised by the Metropolitan Board of Works for main drainage, new streets, parks, and general purposes, including the coal duties appropriated for the Thames Embankment, did not exceed in amount a rate of 9d. in the pound, and that the whole local taxation of the metropolis for municipal purposes was not more than 10s. per head of the population.—I am, &c., W. H. Dalton.
28, Cockspur-street, February 25th, 1865.

Volunteer Fire Brigades.—Sir,—I very much regret to find that, in my endeavour to be as brief as possible in my remarks on Mr. Young's paper, I omitted to do an act of justice to the London Fire-Engine Establishment, and my remarks being still further condensed makes it appear that I have stated a positive untruth. I therefore beg space to correct this. In the report I am made to say that my brigade never received a penny from anyone for their services. This requires explanation. I stated that Mr. Young appeared to forget that nearly all the Volunteer Fire Brigades were equipped and supported by voluntary contributions. . . . . . That the brigade I had the honour to represent was more strictly volunteer than any other, as the engines and plant were found by the firm (Brown, Lenox, and Co.), and the uniforms by the men themselves, without subscriptions from anyone, neither had they ever taken a penny for their services; I ought to have added—as all monies received for such service go to a fund in case of accidents or sickness through attending fires. I believe I am quite correct in saying it is the invariable custom of the London Fire-Engine Establishment to reimburse all volunteer brigades the cost out of pocket, and something in addition when

they are really of any service in extinguishing a fire. The late hour at which I was called upon to speak prevented me from going so fully into the question as I should have wished; but I trust that in consideration of the importance of the subject, you will allow me to make a few further remarks, particularly as lately there appears a tendency to underrate the services of the regular brigade; and I exceedingly regret to see my friend Mr. Young getting into the same track, for he says—"It is constantly said that paid firemen will work better than volunteers. . . . If paid men are best, how comes it that volunteers are always asked for when it is desired to do anything difficult or very perilous, say spring a mine—storm a fort—lead a forlorn hope—rescue a shipwrecked crew?"—This sounds very fine, but my friend appears to have forgotten that the volunteers for the above services are always taken from the class that are trained, aye, and often paid for such work, the soldier for springing the mine, and the sailor for rescuing a shipwrecked crew. Would Mr. Young send a party of Deal boatmen to spring a mine or soldiers to man a life-boat? I venture to say he would not; neither would he ask a fireman or fire-escape man to stand on one side and let some volunteer from the crowd enter a building to rescue life or property. I should very much like to see the volunteer movement spread all over the country; and I believe it is in outlying districts they will be most useful, but many years' experience has convinced me that it will not do to depend upon volunteers to protect London or any other large town from fire. I have formed a very strong opinion as to the best means of protecting such places, and shall be glad at some future time to explain my views either by a short paper or letter in the *Journal*, but I feel at present that I have occupied enough of your space.—I am, &c., Wm. Roberts.

January 31, 1865.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Arts, 8. Cantor Lectures. Professor Ansted, F.R.S., "On the Applications of Geology to the Arts and Manufactures." (Lecture V.)
Entomological, 7.
British Architects, 8.
Medical, 7. Annual Election.
Asiatic, 8.
Royal Inst., 2. General Monthly Meeting. 3 o'clock, Prof. Tyndall, F.R.S., "On Electricity."
R. United Service Inst., 8½. Mr. John Latham, "Some Early Breech-loaders."

Tues. ...Civil Engineers, 8. Mr. H. B. Hederstedt, "An Account of the Drainage of Paris."
Pathological, 8.
Photographic, 8.
Ethnological, 8. 1. Mr. Travers, "On the Destruction of the Aborigenes of Chatham Island by a Maori Invasion." 2. Mr. Hyde Clarke, "On the Inhabitants of Asia Minor, previous to the time of the Greeks."
Anglo-Biblical Inst., 7½. Mr. John Mills, "The Archæology of Palestine and Biblical Criticism."

Wed. ...Society of Arts, 8. Mr. Zerah Colburn, "On Cotton Gins."
Geological, 8. 1. Mr. P. Duncan, "On the Echinodermata from the South-east coast of Arabia, and from Bagh on the Nerbudda." 2. Mr. G. Busk and the late Dr. Hugh Falconer, "On the Fossil contents of the Caves and Fissures at Windmill Hill, Gibraltar." Communicated by the Secretary of State for War. 3. The late Dr. Hugh Falconer, "On the Asserted Occurrence of Human Bones in the Ancient Fluviatile Deposits of the Nile and the Ganges, with comparative remarks on the Alluvial Formation of the Two Valleys."
Graphic, 8.
Microscopical, 8. Dr. Greville, "On Diatomaceæ."
Literary Fund, 2. Annual Meeting.
Medical, 5. Anniversary Oration.
R. Society of Literature, 8½.
Archæological Assoc., 8½.

Thurs...Royal, 8½.
Antiquaries, 8.
R. Society Club, 6.
Royal Inst., 3. Prof. Hofmann, F.R.S., "An Introduction to Chemistry."

Fri.......Astronomical, 8.
Royal Inst., 8. Prof. Ramsay, F.R.S., "On Eozoon (the earliest known Fossil)."
Royal United Service Inst., 3. Col. G. Balfour, C.B., "The Indian Military Establishments, their Organisation and Cost."

Sat.......R. Botanic, 3¾.
Royal Inst., 3. Prof. Marshall, "On the Nervous System."

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 9th February*, 1865.

2. Bank of Ireland—Correspondence.
Colonial Statistics (Part IX.) (1862)—Statistical Tables relating to the Colonial and other Possessions of the United Kingdom.

Delivered on 10th February, 1865.

New Zealand—Further Papers.
Colonial Possessions (Part 1. West Indies and Mauritius)—Report.
Japan (No. I.)—Correspondence.
Japan (No. 2.)—Despatch respecting the Murder of Major Baldwin and Lieutenant Bird.
Turkey (Protestant Missionaries—Correspondence.
Greece—Correspondence.
Denmark and Germany—Correspondence.
North America (No. I.), 1865—Correspondence respecting the Attack on St. Albans, Vermont, and Naval Force on the North American Lakes.
India and Turkish Telegraph—Convention.

Delivered on 11th and 13th February, 1865.

1. Bills—Mortgage Debentures.
2. ,, Qualification for Offices Abolition.
9. ,, Land Debentures (Ireland).
4. General Committee of Elections—Mr. Speaker's Warrant.
1. Public Income and Expenditure—Account.
3. Railway and Canal, &c., Bill—Board of Trade Report.
3 (1 to 29). ,, ,, Further Report (1 to 29).
Poor Relief (Scotland)—Nineteenth Annual Report.
British Kaffraria and Cape of Good Hope—Correspondence.

Delivered on 14th February, 1865.

5. Bills—Courts of Justice Building.
8. ,, Criminal Cases (Evidence).
10. ,, Smithfield Market (Dublin).
11. ,, Courts of Justice Concentration (Site).
Canada—Letter relative to Defences by Lieut.-Colonel Jervois.
British North American Provinces—Correspondence.

Delivered on 15th February, 1865.

6. Bills—Court of Chancery (Ireland).
7. ,, Private Bill Costs.
16. ,, Game Licences (Ireland).
17. ,, Dublin International Exhibition (1865).
10. Reformatories, &c.—Return.
11. East India (Civil Service)—Regulations.
15. Banks—Return.
16. Excise Duties, &c. (Ireland)—Returns
17. Spirits (Scotland)—Return.
24. Charitable Funds—Account.
25. Maynooth College—Report.
32. Police (Counties and Boroughs)—Reports.
Russia Company—Further Correspondence relating to Dues.

Delivered on 16th February, 1865

12. Bills—Bank Notes Issue.
13. ,, Small Benefices (Ireland) Act (1860) Amendment.
14. ,, Bank of Ireland.
19. ,, Elections Petitions Act (1848) Amendment.
20. ,, Law of Evidence, &c.
21. ,, Felony and Misdemeanour Evidence and Practice.
5. Public Works (Manufacturing Districts)—Report.
12. Orders of Removal—Return.
22. Naval Receipt and Expenditure—Account.
40. Arts Schools, &c.—Minute.

Delivered on 17th February, 1865.

3. Bill—River Waters Protection.
19. Russian Dutch Loan—Account.
20. Sardinian Loan—Account.
21. Greek Loan—Account.
23. Navy—Statement.
39. Private Bills—Rules.
Clerical Subscription—Report of Commissioner

Delivered on 18th and 20th February, 1865.

4. Bills—Sewage Utilisation.
18. ,, Land Debentures.
26. ,, Juries in Criminal Cases.
15. ,, Prisons.
24. ,, Insolvent Debtors.

27. Bills—British Kaffraria.
28. ,, Pilotage Order Confirmation.
29. ,, Civil Bill Courts Procedure (Ireland) Act (1864) Amendment.
3 (30 to 39). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 30 to 39.
9. Annuity Tax (Edinburgh)—Returns.
18. Irish Reproductive Loan Fund—Accounts.
31. Drunkenness—Return.
36. Duchy of Lancaster—Account.
38. Russia Company—Return.
45. Bank of England—Account.
60. Army Estimates.
Fisheries (Ireland)—Report of Special Commissioners.

Patents.

From Commissioners of Patents Journal, February 24th.

Grants of Provisional Protection.

Acids, manufacture of citric and tartaric—307—F. Row.
Air cushions, mattresses, &c.—317—A. H. Robinson.
Alarms, apparatus for giving—392—C. West.
Billiard tables, cushions for—316—J. L. Hancock.
Blowing apparatus—427—S. R. Freeman and A. Grundy.
Boots and shoes—381—G. Coles, J. A. Jaques, and J. A. Fanshawe.
Brooches, manufacture of—385—G. C. and J. B. Haseler.
Buildings, ventilation of—332—C. Beard.
Cables, metal chains for—431—W. H. Brown.
Candlesticks—339—A. I. L. Gordon.
Cane juice, &c., treatment for evaporating, &c.—418—A. Fryer.
Cannon shot and shells—346—R. Brandon.
Carriages, construction of—215—S. L. and A. Fuller.
Cartridges—426—B. Thompson.
Clarinets—308—J. Park.
Clog soles, &c., manufacture of—416—R. J. Jones.
Cupolas and blast furnaces—397—H. H. Grierson and J. M. Rigby.
Doors, windows, &c., fastenings for—369—G. E. Meek and W. H. Howes.
Driving bands for machinery, manufacture of—300—G. and D. Hurn.
Embankments, sea-walls, &c., formation of—380—W. E. Newton.
Fibrous substances, breaking the stems of and preparing—336—H. B. Barlow.
Fire-arms, breech-loading—253—W. Clark.
Fire-arms, breech-loading—299—T. Joyce.
Fire-arms, breech-loading—358—E. Lindner.
Fire-arms, breech-loading—421—J. von der Poppenberg.
Fire-arms, breech-loading—424—J. Purdey.
Fire-arms, lever powder and shot charger for—302—W. Bartram.
Fire-arms, locks for—368—J. P. Lindsay.
Fire-arms, patched balls for—367—M. Peck.
Fire-places—407—E. B. Wilson.
Fish-hooks—428—W. A. Hackett.
Furnaces and boilers—395—J. Cass.
Garment, combined—423—R. P. Barrett.
Garments—355—J. Singer.
Grain, apparatus for separating—348—W. E. Newton.
Grain, mills for grinding—333—W. P. Wilkins.
Grease for lubricating, manufacture of—354—J. Desmontils.
Gunpowder—402—L. H. G. Ehrhardt.
Guns, breech-loading—265—C. H. Russell and J. Needham.
Hair brushes—214—C. Roques.
Hair-pins—325—R. A. Brooman.
Hops, obtaining the concentrated extract of—306—J. R. Webb.
Hydraulic lifting apparatus—328—A. Steven.
Hydro-carbons, supplying a regular pressure of air to burners for consuming—408—E. J. C. Welch.
Ink, typographic—330—A. A. Hulot.
Iron, cast and wrought—419—E. H. Newby.
Iron safes and strong rooms—364—J. Chubb.
Jacquard apparatus for weaving—329—W. Cockburn.
Jacquard machines, protector for the needles and cards used in—429—W. C. Ridings, sen.
Keys, removing dirt from inside the barrels of—238—R. Helsham.
Lead, purification of—310—J. A. Phillips.
Leys, treatment of spent or used—297—T. Routledge.
Life belts, swimming belts, &c.—341—C. Kilburn.
Looms—293—J. Maynes.
Looms—377—R. G. Hazard.
Looms, healds for—347—A. A. Larmuth.
Mathematical compasses—235—J. E. F. Ludeke.
Metallic casks and drums—327—G. Duncan.
Metal pipes, mode of making—356—W. Anderson.
Miners' safety lamp—353—R. C. Thorp and P. Young.
Money, tickets, &c., apparatus for counting—383—J. Schneuhr.
Mooring anchors—420—J. Trotman.
Motive power, obtaining—331—J. I. Watts.
Netting, manufacture of wire and other—360—R. A. Brooman.
Oil for machinery, production of—388—J. Hall.
Ores, extracting gold and silver from—391—W. Crookes.
Ores, furnaces for smelting iron—374—E. Leigh.
Ores, furnaces for smelting or reducing—411—H. J. Walduck and E. Barton.
Paper-hangings, manufacture of—322—J. Booth.
Peat for fuel, manufacture of—319—R. M. Alloway.
Pencil cases, manufacture of—298—W. Vale.
Pencil-holders and pen-holders—352—W. E. Wiley.
Penholders, manufacture of—406—F. C. Vannet.
Presses, fly or embossing—208—J. Bailey.
Pressing irons heated by gas, ventilation of—350—S. E. Rosser.
Pumps—436—G. T. Humphris.
Railway chairs, &c.—318—R. Richardson.
Railway engines, &c., bogie trucks for supporting—404—W. Adams.
Railways, ships, &c., signal applicable to—357—A. W. Banks.
Railway switches, &c., working and controlling—432—M. Lane.
Resinous wood, extracting turpentine and tar from—403—J. A. Pastorelly.
Rivetting, machinery for—400—H. M. Kennard.
Satin white, substances to be used in place of—371—J. Dale.
Sewing machines—304—W. Clark.
Sewing machines—430—A. V. Newton.
Sewing machines, operating the working parts of—370—A. V. Newton.
Sewing machines, single thread—396—A. V. Newton.
Sheep shears—294—J. Ball.
Ships and vessels—337—R. Brassens and F. A. Le Mat.
Ships, apparatus for discharging coals and other cargo from—359—G. Elliot and H. Coxon.
Ships, armour-plated—438—G. T. Bousfield.
Ships, forts, &c., armour-plated—292—C. Lungley.
Stamps and labels, apparatus for affixing—379—H. W. Hart.
Stay busks, &c., fastenings for—349—G. Twigg.
Steam, application of hydro-electricity to—273—J. Fletcher and D. Hamer.
Steam boilers—401—R. W. Thomson.
Steam boilers, combustion of fuel in the furnaces of—311—F. C. Hills.
Steam boilers, preventing the explosion of—305—J. Westerby.
Steam engines, expansion gear for—415—W. F. Batho.
Steam generators—345—J. Lake.
Straw, &c., machinery for cutting, sifting, &c.—340—J. Cornes and W. Simpson.
Strained wire or rod fencing, standards for—76—W. Bayliss.
Telegraphs, insulating material for—362—W. A. Marshall.
Textile fabrics, rendering uninflammable—313—E. Hottin.
Tooth powder—301—B. L. Mosely.
Vermin traps—312—R. S. Baker.
Vessels, &c., armour-plated—296—J. S. Jeffreys.
Water, apparatus for heating—390—A. McLaren.
Waterproofing skins, &c.—413—G. Harton.
Wearing apparel, skirt borderings and linings for—361—W. Staats.
Window safes—326—R. Shaw.
Wood, &c., varnish for preserving—315—R. A. Brooman.
Wooden surfaces, preservation of—363—J. C. C. Halkett.

Patents Sealed.

2119. J. Cheetham.
2120. W. Rowden.
2121. F. W. Armitage.
2127. J. Packer.
2129. J. Shanks.
2133. C. W. Harrison.
2136. A. E. Peirce.
2141. Sir J. Macneill.
2145. T. Wilson.
2146. J. White.
2153. J. H. Wilson.
2159. P. M. Parsons.
2173. M. A. F. Mennons.
2299. M. A. F. Mennons.
2343. J. Todd.

From Commissioners of Patents Journal, February 28th.

Patents Sealed.

2158. A. M. J. Count de Molin.
2160. M. Barland.
2161. R. A. Brooman.
2162. W. W. Burdon.
2163. J. Ivers and T. Ogden.
2168. T. E. Symonds.
2177. D. Walker.
2192. J. S. Crosland.
2215. J. Holding.
2235. A. C. Kirk.
2278. F. Yates.
2286. D. Tamet.
2304. W. P. Struvé.
2337. H. Vale.
2341. A. V. Newton.
2379. T. Powell.
2383. J. Jongen.
2437. G. Haseltine.
2578. W. Clark.
2604. F. Martin.
2618. H. Bird.
2690. J. Solomon and A. G. Grant.
2843. N. Bailly, C. Durand, G. H. Mesnard, and Z. Poirier.
54. H. Ames.

Patents on which the Stamp Duty of £50 has been Paid.

532. G. Torr.
464. E. S. Crease.
479. D. B. White.
480. G., S., and J. Blakey, and B. White.
492. T. N. Kirkham and V. F. Ensom.
509. J. Imray.
510. J. Whitworth.
824. T. Guibal.
489. R. Waller.
494. T. Partridge, sen.
499. J. Carnaby.
585. J. Gjers.
504. E. Bliss and H. Lamplough.
530. J. Medhurst.
546. A. W. Makinson and W. F. Batho.
552. J. Parker.
584. F. B. Houghton.
587. B. Standen.

Patents on which the Stamp Duty of £100 has been Paid.

329. W. Thomson.
365. J. Petrie.
621. J. F. Brinjes, jun., and H. J. Collins.

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Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

March 15.—"On Marine Engines from 1851 to the present time." By N. Procter Burgh, Esq., C.E.

March 22.—"On the Preservation of Food, especially Fresh Meat and Fish, and the best form for Import and Provisioning Armies, Ships, and Expeditions." By G. C. Steet, Esq.

March 29.—"On Window Horticulture, and the Cultivation of Plants and Flowers in Cities and Crowded Localities." By John Bell, Esq.

Cantor Lectures.

The concluding lecture of the Second Course, the subject being "The Applications of Geology to the Arts and Manufactures," by Professor D. T. Ansted, M.A., F.R.S., will be delivered on Monday evening, at Eight o'clock, as follows:—

March 13th.—Lecture 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture.

Proceedings of the Society.

Cantor Lectures.

Second Course.—Fifth Lecture.—Monday, Mar. 6.

Ironstone and Coal.

Professor Ansted first pointed out that iron and coal were the chief sources of material wealth, and that Great Britain was especially provided with these minerals. The circumstances under which iron ores and mineral fuel are found, the extent of the deposits, and the way in which they may be obtained, were the subjects to which he would now direct the attention of his audience. Iron is widely disseminated, and forms part of almost every substance with which we have to do. But although thus common, the ores are not universal. In most of them iron is in combination with oxygen. These include magnetic iron ores, specular iron ore, red hæmatite, and micaceous iron, and numerous hydrates, called brown hæmatites. There are also spathic iron, brown spar, and clay ironstone. Silicates and phosphates of iron are also sometimes used. The richest ores are the protoxides; the next the peroxides; and the least rich, but most abundant, the carbonates, or rather the carbonates of the oxide. The phosphates are sometimes rich in iron, and the silicates also. The former are chiefly worked in Canada; the latter near St. Maurice, and in the Canton of the Valais, in Switzerland. The sulphides are valued only for the sulphur they contain. Magnetic iron ore is a rare mineral in England. It is diffused in the old rocks, but is not abundant. The chief supplies are from Norway, Sweden, and Russia. The central portion of the island of Elba is of this material. Important veins of it exist in India and the East, in North America, in Mexico and in Brazil. It contains, when pure, 72 per cent. of iron. The hæmatites are more common with us than magnetic ore. They are rich in iron, but it is more profitable to mix them with the poorer ores than to use them alone. There are two kinds; one yielding, theoretically, 69¼ per cent. of iron, and the other 56 per cent. The ores are rarely free from foreign substances. The crystalline are either specular ores, micaceous ores, or oligist. The earthy ores are opaque and red, whence the name "hæmatite," or blood-stone; but when containing water, this colour passes into brown. They are valuable for smelting. They are also used for polishing; and some varieties are employed as pigments. The carbonates of iron, yielding from 20 to 45 per cent. of metallic iron, are sometimes crystalline, as in sparry iron, but more often earthy, as in the common ores of most parts of England. They form the group of clay ironstones. The chief mines of hæmatite in England are at Ulverston and the neighbourhood of Whitehaven. at the bottom of the limestone in contact with slate. At Todholes, near Cleator, this ore is worked as a quarry. The floor of the deposit is a white and red mottled shale of the limestone series, almost a fire-clay, and 40 feet thick. The surface of the shale is uneven, and is covered by white quartz pebbles. Then comes a magnificent bed of hæmatite, from 15 to 30 feet thick (sometimes as much as 60 feet), subdivided by irregular joints. Bands of greenish-black shale are interstratified with this ore. It is difficult to say whether the ore is a contemporaneous deposit. It is extracted in the manner adopted in the case of coal, and the quantity removed is large. Besides these mines, the same ore has long been worked from the carboniferous limestone of Low Furness, in a deposit resembling a chasm or vein, and at Dalton, under similar circumstances. Curious dish-

shaped deposits of hæmatite exist in the same neighbourhood. Some of these are 50 yards in width, and 20 yards deep. The ore in them is only covered by drift. The ore is fine and crystalline. From one point you may proceed 400 to 500 feet in either direction in one solid mass of this valuable substance, and its bottom has not been reached. Other hæmatites are from Derbyshire, the forest of Dean, Somersetshire, and South Wales. Those of the forest of Dean seem almost inexhaustible. The coal measures are equally rich in clayey iron ores. They are impure, earthy, and carbonaceous minerals, among which iron oxide is present to a large extent. The clay ironstones are black, blackish-brown, yellowish-brown, pale yellow or drab. They are sometimes regular bands and sometimes groups of nodules alternating with coal-bearing deposits. In the Bradford districts (Yorkshire) there are groups of bands near the bottom of the coal measures: the upper group contains five bands, which are valuable though not pure. They contain 36 per cent. iron oxide and 25 per cent. carbonic acid, besides nearly 20 per cent. of silica. In Derbyshire the ironstones are numerous, and they yield from two to six thousand tons per acre. The most remarkable is the "Black shale," of Stavely, near Chesterfield. It consists of two groups: the upper containing nine, the lower twelve seams, half an inch to 1½in. in thickness. The Shropshire and North Staffordshire coal-fields yield some excellent qualities of ore adapted for making the best kinds of iron, but the quantity per acre is not large, nor are the ironstones rich. In the Potteries coal-field the ironstone bands are in the upper part of the field, agreeing with South Staffordshire and North Wales. The ironstones of these districts include the *black bands*, originally worked in Scotland. In South Wales, the coal measures form two series, the lower containing the great bulk of the iron bands. These may be followed across the Bristol Channel to Ireland, but are there poorer than in Wales, yielding an average of less than 20 per cent. Scotland is exceedingly rich in similar ores. Within a few years enormous deposits of iron ore have been obtained from the Cleveland Hills, in the east of Yorkshire. On the coast there crops out a thickness of fifteen feet of ironstone, containing an average of 30 per cent. of metallic iron, but, unlike an ore, resembling an irony sandstone, its surface deeply rusted. It occupies the position of the marlstone in the middle of the lias formation, and extends over a region of some hundreds of square miles, thinning out towards the south. The supply must be regarded as practically indefinite, and it is obtained with extreme facility. Its yield at one point near Eston, has averaged 50,000 tons per acre, and the available ore per acre would average 40,000 tons, yielding 10,000 tons of metallic iron. In France, also, the oolitic rocks are partly made up of rich ores and of iron, the ores being earthy and not easily recognised, except by those who trust to analysis instead of appearance. The value of such ores is about equal to that of English oolitic ores, the general average being about 30 per cent. The most remarkable beds of ore are in the centre of France, not far from coal. Belgium and Germany are not less rich in valuable ores than France; but they are not always available for the manufacture of iron, as, without fuel, the richest iron ores are of little value. The value of ironstone depends much on the supply of fuel at hand, and thus the ironstones of the coal measures, though not rich, are important; while it is only from accident that other ores possess the value now attributed to them. In the north of Europe, where there are forests, and cheap labour, charcoal iron may be made of the pure ores of these countries; and in India, smelting can be carried on to advantage in small furnaces, but these are exceptional conditions. The methods of obtaining iron ore vary according to the position of the ore, the magnitude of the deposit, and the presence of other useful minerals. In the lias and oolites, the ores are removed by digging or quarrying. In the coal measures they are raised with the coal. The system of bell pits is adopted where the ironstone nodules of the lower coal measures come close to the surface. There are small shafts arranged in great numbers on the line of strike at a distance of a few yards from each other, and in the Forest of Dean the ore lies in open spaces in the limestone, called "churns," or "pockets." In mining it is cut away, leaving natural pillars. The contents of the deposits vary, both in quality and quantity, and the result is a picturesque irregularity, strongly contrasting with the monotonous galleries of coal mines. To utilise the poorer ores of iron, admixture of other mineral is needed in the furnace. This is called a flux. With the common ores limestone is a flux. The richer ores can be reduced at once with charcoal in small quantities; the great operations of iron smelting are confined to those countries where the claystones and limestone abound, and where there is also an abundant and cheap supply of mineral fuel. Everything thus resolves itself into a question of coal. Where there is coal other things are at hand. When coal is absent other mineral wealth is comparatively useless. Too much attention cannot be given to the history of mineral fuel, that we may know where to expect deposits and how to obtain them. There are many varieties of mineral fuel differing in their properties and in the circumstances of their occurrence. I do not include among coal the shales which simulate coals, and are sometimes reckoned as part of them, but only the coals strictly so called, namely, the anthracitic and bituminous varieties and lignites or brown coal. Some have no value for commercial purposes, but their carbon contents are all strongly marked, and the carbonates afford the best measure of their relative practical utility. Lignites are inferior to coals. They are irregularly distributed in rocks of the tertiary period. They are so far altered as to have a mineral aspect, but they retain a woody character. They exist sometimes in masses of enormous dimensions, but not in regular beds. In England they have no value, but in Germany there are important deposits. This kind of fuel labours under a great disadvantage. It contains water (at least 10 per cent.), which only is got rid of by drying in the air. Lignites contain much ash. Thus, when burnt, much of the heat is left in the conversion of the contained water into steam; and part is wasted on the ash. But lignites are not to be despised as fuel. They have been found available for manufacturing purposes, for iron smelting, for railways, and for steam-boats. In the valley of the Rhine, on the shores of the Baltic, and in Styria, are some of the thickest of these deposits, approaching 200 feet in thickness. The very best lignites may be detected on exposure. After a short time they change, and in a few months fall to powder. They must thus be brought into use immediately after coming out of the mine. Most of the newer deposits of mineral fuel are lignites. The exact reason of this is not clear. It was long regarded as an axiom in geology, that no coals were deserving of the name but the carboniferous period. Real coal exists, however, not only in secondary rocks, but in tertiaries. This is proved by the contents of a remarkable coal-field in the valley of the Zsil, in Transylvania. There, in tertiary sands, are regular seams of excellent coal, very thick, and standing every test. Chalk, the oolites, and the lias also contain coal. In England the Kimmeridge coal is a rich bituminous shale. The Brora field possesses two seams, worked by pits sunk 80 or 100 yards. The coal is bituminous, and burns to a white ash. The Whitby coal has been worked more than a century, and is of fair quality. There is excellent oolitic coal on the Danube. One deposit is at Fünfkirchen, not far from Pesth. Though poor in appearance, and powdery, this coal burns well, with flame and much heat and without much ash. The Ovavicza coal is inferior to the Fünfkirchen, but supplies the Vienna and Basiasch railroads. Asiatic coals are chiefly from oolitic rocks. There are five coal districts—three in Northern India, one in Cutch, and the fifth on the coast of the

Burman empire. The coal is associated with limestones, clays, and ironstone bands. The South African coal is from rocks of the same age. A large tract in Eastern Virginia contains valuable oolitic coal, worked near Richmond. There are three seams, one of them 30 or 40 feet thick; the total thickness about 30 feet. The coal is adapted to the manufacture of gas, but varies in different parts of the field. The great coal fields of England, of Belgium, of Spain, of France, and of North America, besides those of Bohemia, Moravia, and the Rhine, of Russia and China, and probably of Australia, belong to the Palæozoic rocks. The coal-fields of Great Britain range from Somersetshire, in the south, to Ayrshire, Lanarkshire, and Fifeshire, in Scotland, in the North. There are four principal groups of deposits, distinguished as the Northern, Eastern, Western, and Southern. These again are subdivided, and we have, in a different order, the following coal-fields:—(1) the Newcastle coal-field, (2) the Cumberland and Westmoreland coal-fields, (3) those in the West Riding of York, (4) the South Lancashire coal-field, (5) the Flintshire coal-field, (6) the great Yorkshire and Derbyshire coal-fields, (7) the North Staffordshire, (8) the Coalbrook Dale and other Shropshire coal fields, (9) the Worcestershire coal fields, (10) the Leicestershire, (11) the Warwickshire, (12) the South Staffordshire, (13) the Forest of Dean, (14) the British and Gloucestershire group, (15) the South Welch coal-field. In Scotland, in the valley extending from the Firth of Forth to the Firth of Clyde, we have (16) the Clyde Basin, (17) the Ayrshire coal-field, (18) the Lesmahago Basin, (19) the Clackmannan coal-field, (20) the Fifeshire, (21) the Lothians, and (22) the Dumfries. All supply bituminous coal and some also yield cannel coal, steam coal, or anthracite, and all are liable to faults of all degrees of magnitude, and every variety of condition. The faults are sometimes mere interruptions of continuity, but sometimes wide gaps filled with stones or rubbish. There is no doubt of the vegetable origin of coal; but it still remains a mystery how coal was formed, or what combinations were necessary to produce it. In most cases it represents a mass of vegetation that must have taken many years, or a large area, to accumulate, but yet in some instances there is proof that it must have accumulated rapidly. It seem to have accumulated near the mouth of large rivers or low swampy flats. Bituminous coal is brittle, burns with flame and smoke, and gives off gas on dry distillation. It contains from 10 to 30 per cent. of volatile substances, and leaves a residue of coke. Caking coal is a variety which runs together in the fire. Cannel coal, or parrot, is compact. does not soil the fingers, and can be sculptured. It burns like a torch or candle, with much light and smoke, and contains from 40 to 60 per cent. of volatile substances. Steam coal is a hard semi-bituminous coal, with little volatile matter, but burning freely with flame and much heat. Anthracite is free carbon, homogeneous, and with conchoidal fracture. Some varieties are powdery or flaky; some resemble graphite. The Newcastle coal-field (1) has been the most extensively worked of any. Till lately it yielded bituminous coals and cannel, it now also yields excellent steam coal. Its coal is valued for household use, and it makes the finest coke. No anthracite has been found here. The area occupied by coal contains about 700 square miles, and is divided by a great fault crossing the whole field from east to west, the strata being lowest on the northern side of the fault by ninety fathoms. There are no important bands of ironstone. There are forty seams in the Newcastle field, but only eighteen are workable. The most valuable is two yards thick. The total thickness of workable coal is eighty feet, and the mean thickness of workable coal four yards. Some of the best seams are worked out to a considerable depth. Estimating the area of 450,000 acres, the average thickness at four yards, and the weight of the coal at one ton per cubic yard, the field would contain eight thousand millions of tons of coals. The Whitehaven field yields valuable coal. Its extent, with two other small fields adjacent, is 100,000 acres. There are seven workable seams, the thickest of which is eight feet. They are worked under considerable difficulties, and at great depths, sometimes beneath the sea. The coal is good and caking. The South Lancashire coal-field (4) supplies the vast population concerned in the manufactures carried on in that part of the kingdom. The coal occupies an irregular area. It is found not only in the coal measures, but in the millstone grit, and the whole area includes a thousand square miles of strata. Many of the coals are thin, and the sections are unequal. In one direction there are 75 beds of coal in 2,000 yards of measures, the total thickness of coal being 150 feet. In another direction there are only 26 seams, though the total thickness of coal is 90 feet. The thickest bed is ten feet. The quality is good. There is excellent cannel worked near Wigan and elsewhere, particularly valuable for gas. The available coal has been estimated at 4,000,000,000 tons, but the evidence is very imperfect. The sinkings are not deep, and the quantity of water is not excessive. The Flintshire and Denbighshire coal-field (5) is smaller and much worked. There are five workable seams, of which one is nine feet thick. The total thickness of coal is nearly 40 feet. Among the beds is a cannel, called curly cannel, extremely rich in hydrocarbons. The Yorkshire coal-field (6) supplies many large towns in the north of England. The number of seams is not large, but one of them is ten feet thick, and there more than thirty feet of workable coal. The quality is excellent, and the pits of moderate depth. There are also very numerous bands of ironstone. The North Staffordshire or Pottery coal-field (7) contains a number of good seams of excellent coal. Here there is forty feet thick of coal, in twenty-four seams, one of which is ten feet thick. With the coals are ironstones. The South Staffordshire coal (12) is brought up by faults through the new red sandstone. It has one seam, called the "ten yard seam," exceptional among the English coals. In other countries are many beds of coal that bear the same proportion to this that the thick coal of Staffordshire does to the six-foot coals of Newcastle. The Forest of Dean has been less worked than some, but is of considerable importance. Near it, in Gloucestershire, is another small coal-field. Near Bristol there is an extensive and important coal district, now much worked, and yielding a large supply of excellent fuel. We come nexs to the great South Welsh coal-field (15), which includet 900 square miles. It is divided into three unequal parts; the west anthracitic, the middle steam coal, and the east bituminous. With the coals is ironstone; generally thin, but of good quality. The thickness of coal is 70 to 100 feet. Although the estimates of the total quantity of coal are exaggerated, it is the largest and most important in the British islands, and its resources will be available long after the smaller coal areas of the north have been exhausted or rendered unworkable. The Scotch coal-fields are both numerous and rich. Most of the coals are dry, free burning, but not caking. They belong to the lower members of the carboniferous series, and are older than the English coals. The total area is 1,600 square miles. Coal has been long worked in Scotland, and the total quantity raised amounts to 12,000,000 tons. An important part of the Scotch coal is made use of for distillation, to obtain paraffin oils. Ireland has coal-fields, both bituminous and anthracitic. The former are small, but the coal is abundant. The anthracitic deposits are more numerous and more worked than the bituminous. The coal of Munster is the most developed. Belgium is rich in coal, and the province of Hainault, the western division of the coal-field, is very remarkable. Every variety is found there—from pure anthracite, burning without flame, through the rich bituminous kind called "*Charbon gras*," making excellent coke, to the flaming coal or cannel called "*Fléau*." The most valuable of all is called "*Charbon maigre à longue flamme*." France possesses a very large number of small coal-fields. Those in the northern departments are portions of the Belgian

coal-fields, and contain the same varieties of coal. In the eastern part of the country, as at Saarebrück, on the Moselle, there are others of the same nature. In the interior the most important are in and near the Basin of the Loire. In central France there are numerous small basins, in some of which the thickness of the coal is extraordinary. At Aubin there are 124 yards of solid coal in eight seams, one of which measures fifty yards at its outcrop. In Rhenish Prussia the basin of the Ruhr, near Düsseldorf, is the seat of important coal mining operations, and the Saare coal-field extends from France into Germany. The chief German coal-fields are those of Bohemia and Silesia, Moravia and Galicia. The total yield of bituminous coal from the Austrian empire in 1860 was about one and a-half million tons. Some of the rivers of Russia, and some localities on the shores of the Black Sea yield good coal. The Iberian peninsula is very rich in coal. In the Asturias, there is a coal area of very large dimensions, containing upwards of a hundred workable seams, varying from three to twelve feet in thickness. In the south of Spain, in Portugal, and near Barcelona, there are workable coal seams. There are coal seams almost within the arctic circle. North America contains coal-areas, compared with which the richest deposits of Europe sink into insignificance. The chief are the coal-field of the Alleghanies, including the basin of the Ohio and the coal-field of Illinois, the basin of the Missouri, and the coal-fields of Nova Scotia, New Brunswick, and Cape Breton. The Alleghany coal-field measures 750 miles in length with a mean-breadth of 85 miles, and traverses eight principal States, among which are Virginia, Pennsylvania, Ohio, Kentucky, and Alabama. Making a liberal deduction for unproductive portions, denuded strata, and unattainable depths, there are 25,000,000 acres of valuable coal-field. The coal is partly bituminous, partly anthracitic, and the seams numerous and convenient. The Illinois field includes the Indiana district, where a rich bituminous coal extends over an area of 8,000 square miles. There is another great coal-field in Missouri. British America supplies coal in New Brunswick, Nova Scotia, and Cape Breton. The New Brunswick beds are thin. Nova Scotia is extremely rich, and contains one seam of thirty-four feet of good coal, besides others of ordinary proportions. The coal is excellent. South America contains coal on the coast of Brazil. China and Japan possess mineral fuel extending down the eastern side of Australia, where coal has been long worked. The Chinese coals were worked at least six centuries ago, both anthracitic and bituminous. New Zealand contains coal. Borneo has large deposits. The methods adopted to obtain coal constitute the practice of mining; they vary according to the position of the coal, the thickness of the seam, the nature of the rocks above and below, the quality of the coal, and the quantity of gas it gives off underground. The quantity of water also enters into consideration. If coal crops out on the side of a valley, it can be got readily, and at small expense, by levels or galleries tunnelled into the side of the hill. Coal, however, being rarely horizontal, a gallery, following the dip of the coal, will incline down-hill on one side and up-hill on the other side of the valley. In the first case any water that enters will escape, but in the other it will accumulate. The coal also can be run out readily in the one, and must be drawn up-hill at some expense in the other. Thus, it is only when coal is horizontal or dips towards a valley, that crop workings can be carried on with advantage. In the other case it will be better to sink a pit and obtain the coal by running a drift from the bottom of this pit. Crop workings are confined to the early workings on a seam. Coal at its outcrop may sometimes be obtained by quarrying when the seam is thick, and retains its quality as a useful fuel after long exposure to the weather, but in England such workings have long ceased to have much value. Among the more remarkable open workings is one at St. Etienne, near Lyons, in France. When underground works are to be reached by a pit or shaft, it becomes a matter of importance to know whereabouts, at what depth, and in what state the coal lies. Where the outcrop is known, the dip of the coal regular, and the coal not faulted, this is not a difficult task. But the permanent inclination of a coal seam is not always the same as its dip at the outcrop, and faults must not be left out of calculation. Better ground for an opinion than calculation is therefore necessary, and boring must be resorted to, that we may learn the general relations of the beds and the depth to a known point in the series, after which calculation is easy. Three borings are necessary where the coal is not already proved, and its outcrop is not clearly known. Several are required when there is reason to expect faulted ground. When all is known that can be made out concerning the circumstances under which the coal lies in any given property, the next operation is to sink a shaft to intersect the bed at a certain depth, so that all that is possible of the coal seams of the district may be worked. Great experience is needed to decide this point. On the one hand, if the pits are too deep, unnecessary expense is incurred, not only at first, but afterwards, in getting as well as reaching the coal, and in lifting the water. On the other hand, if they are so placed as not to be able to remove the coal from the extremity of the estate, that portion will be lost; for after expensive pits have been sunk, and much of the coal got, it will not be worth while to get the rest by a fresh sinking. So with regard to faults, if the pits be sunk without reference to them, great difficulty may be experienced and heavy expenses incurred that might be avoided by greater knowledge of the ground. When coal is being got from near the outcrop, it is usual to sink many more shafts than when the mine is deep. The enormous cost of deep shafts justifies this economy, but there are both disadvantages and great dangers in mines that are carried on by a single shaft or by shafts too far apart. In the event of an accident, either to the shaft or in the ventilation, communication may be entirely cut off, and thus a heavy loss of life may result. Thus the determination as to the number and position of the shafts is a matter to be very carefully considered. In shallow mines, the pits are generally single and of moderate size. In deep mines, they are in pairs, or one very large shalf is divided into three portions. A shaft or shafts being decided on, the work of sinking commences. The rocks through which the sinking has to pass will some of them be water-bearing beds, and would supply strong springs, if that were the object of the sinking. If water is reached while sinking, it must be shut off; if it come in at the bottom, it must be pumped out. The only way of shutting it off is by lining the shaft with an iron casing passed down as the sinking proceeds. The bottom of the shaft is the coal seam which it is intended to remove. When the coal is reached, and there are two pits, these are immediately connected, partly for ventilation, and partly for the convenience of further workings. One pit should be free, and serve as a chimney for carrying off the air, which is injured by the breathing of the men, or by emanations of gas from the coal. During the sinking of each pit, if more air is wanted than naturally comes down, the shaft is divided into two portions by a partition, and ventilation is effected by artificial means. If there is a pair of pits close together, they are usually sunk on the line of dip of the beds, so that one shall reach the coal at a greater depth than the other. In this case a natural ventilation sets in, one shaft acting as a chimney to carry heated air up, and the other as a pipe down which the heavier air descends. When coal is reached, a drift or tunnel is carried on it in the direction of the strike. In the case of a pair of pits two such drifts are cut, one from each. This enables the field to be laid out conveniently, and reveals the condition of the coal, tho state of the roof, and the continuity of the seam. Along these roads the coal when removed can be drawn. Along the lower drift, or by the side if there is a single pit, the water of

the mine is conducted, and when there is a pair of pits, the lower of the two drifts is called the water-gate, and the upper the horse-gate. At right-angles to such drifts, and on the rise of the coal, another gallery is driven, called the winning headway, or, in Yorkshire, the main board-gate. If there be a second shaft at a distance, it is convenient that this should communicate with the winning headway. The further working of the mine may be carried on either by the pillar and stall or the long wall method. The former is adopted in the Newcastle coal-field, and has been introduced with modifications into many other districts. The latter is that followed in the coal-fields of Yorkshire. In the Newcastle coal-field, where the coal lies deep, where there is much water, and where shafts are costly, and the coal full of gas, it is found convenient to divide the coal property into a number of panels, or divisions, kept separated by a thickness of forty or fifty yards of coal. Each panel is worked independently, beginning with that most distant from the shaft. Levels are driven at right angles to each other, leaving large pillars of coal to keep up the roof, till the whole panel is laid open. When such galleries have been completed the pillars are attacked, carrying away as much as possible, supporting the roof for a time with wooden pillars, and ultimately removing the pillars, and allowing the roof to fall. The farthest panel being removed, the next may be attacked, and so on till the work is completed. In Yorkshire, where the depth is less and the coal harder, with faults less troublesome, the long wall method is adapted. By this, drifts are run through the coal from the main board gate parallel to the winning headway, and the coal is left in a number of long walls supporting the roof. When the mine is thus laid open, the walls are entered by small cross drifts, and the greater part removed, and the roof allowed to fall. In coal mines, there is a cause of difficulty and danger arising from the light carburetted hydrogen gas existing in the coal and emitted under ground, especially where the coal has recently been broken. Besides this fire-damp, choke-damp, or carbonic acid gas, is not unusual. Both have to be provided against by ventilation, and thus the conveyance and distribution of air is essential in laying out a coal mine. Mixed with atmospheric air, this light gas, when exposed to flame, explodes, leaving after explosion carbonic acid gas and a small quantity of water. When a large quantity of gas issues from coal, and mixes with the atmospheric air carried down for ventilation, as soon as the proper mixture is obtained the light from an open candle would explode the whole, leaving behind a poisonous, heavy gas, which must inevitably choke those who have not already suffered by the explosion. By the ventilation of mines, dangerous mixtures of gas should be rendered as unlikely to occur as possible, and, by a safe method of lighting, the danger, when it exists, should be avoided. But perfectly safe ventilation and a perfectly safe light are not easy to find, and accidents still occur from neglect of proper precautions. The ventilation of mines is conducted by producing a strong draught up one shaft by means of a fire at the bottom, or by exhausting the air by steam or other means at the top. All the air entering the mine by the other shaft or shafts is forced to take a course through the workings, and along the levels, before reaching the up cast shaft. Extreme care and attention is needed to ensure the ventilation being adapted to the issue of gas, and to avoid a dangerous mixture. But a safety-light is needed, even where the ventilation is most perfect and best looked after. Such a light was provided in the Davy lamp, and it is theoretically perfect if the explosive gas in the mine be light carburetted hydrogen, and if due caution be used. This lamp is a common oil lamp, covered with a metallic gauze, so open that little light is intercepted, but so close that flame cannot pass. The gas poured into a mine from certain kinds of coal, or from empty spaces met in working coal, is sometimes large in quantity, and issues with so much force as to overcome all efforts to render it safe by mixture with atmospheric air. In such mines there is a constant singing heard, especially where the coal is newly broken. In such case the use of the safety-lamp is necessary, if indeed it is right to carry on work at all. Gas accumulates in old workings, and when these are reached, either in continuing the works of the same mine, or in any other way, there is great danger. Many of the worst and most fatal accidents have happened in this manner. When coal has been removed the roof will fall, or if supports are left, the pressure on the floor will drive that up. There must thus in all neglected works be a vast pile of broken rock in which great open spaces are left, and in these the gas becomes stored. Such a pile is called the "goaf," and the depression that appears at the surface when the roof of a mine is fallen is called "creep." These are a few of the many points that suggest themselves in reference to the practical geology of coal-mining.

FOURTEENTH ORDINARY MEETING.

Wednesday, March 8th, 1865; Lieut.-Colonel J. P. Kennedy in the chair.

The following candidates were proposed for election as members of the Society:—

Newcombe, Cornelius Prout, 16, Barnsbury-villas, Liverpool-road, N.
Perkes, Samuel, West Dulwich, S.
Scott, Colonel, R.E., Ealing, W.
Tanqueray, Arthur Charles, Hendon, Middlesex, N.W.

The following candidates were balloted for and duly elected members of the Society:—

Giles, Francis, 42, Blomfield-road, Maida-hill, W.
Phillips, Major Thomas Scott, 10, College-crescent, Finchley-road, N.W.
Savile, Edward B., 30, St. George's-road, Pimlico, S.W.
Spriggs, William, 10, York-row, Kennington-road, S.
Templetown, Major-General Viscount, C.B., Government House, Devonport.
Walker, Micajah Hilditch, 13, St. Swithin's-lane, E.C.
Warden, J. William, Warwick Cottage, Park-village East, N.W.
Yardley, Vincent, 3, Thorney-street, Bloomsbury, W.C.

The Paper read was—

ON THE GINNING OF COTTON.

By ZERAH COLBURN, Esq., C.E., Memb. Inst. Civil Engineers.

It was for a long time the habitual boast of the planters of the Southern States of America that "Cotton was King, that it ruled England, and that they, the planters, ruled cotton." The American civil war itself was in some measure due to this delusion. In renouncing Federal authority the Southern people, then unprepared for war, were almost unanimous in the belief that England would interpose, either by diplomacy or by arms, as might be necessary, to prevent any interruption in her supply of cotton.

In 1860, when our total consumption of this great staple was 1,083,000,000 lbs., exceeding that of any previous year, five-sixths of that supply was drawn from America. Last year we consumed but 561,000,000 lbs., or about one-half as much as in 1860, and of this less than one-twelfth was drawn from the once United States. In other words, nineteen-twentieths of the American supply has been lost to us, and with the failure of the recent negotiations for peace and with the certainty of the overthrow of American slavery, no one can pretend to say when any portion of this loss will be recovered. At present the mills of Lancashire are mostly supplied from India, the larger proportion of Indian cotton being grown in the Central and Western provinces, and shipped from

Bombay. The virtual monopoly which the Indian cultivators now enjoy cannot, however, be said to have resulted either from the force or the policy of British rule in the East. Nor is India as well suited as some other countries to the growth of good cotton. The indigenous staple is of inferior quality, and the country needs irrigation before a good return can be had from exotic seed. It has been rather our necessity, and the growing commercial influence which this country exercises in India, that has brought forward such large supplies upon such short notice.

Previous to the American war, no country in the world could have competed successfully with the Southern planters of the States in the growth of cheap and excellent cotton. In 1849, the quality known as fair New Orleans was as low as $4\frac{1}{2}$d. per pound in Liverpool, and it averaged no more than 6d. for a series of years. The Mississippi low lands will produce yearly from 250lb. to 500lb. of clean cotton per acre, or nearly five times as much as in the best cotton districts in India. The American planter is his own landlord, and beyond the interest on the cost of his farm and of his slaves,—the latter cultivating crops for their own food also—his labour costs him next to nothing. Before the war he was lightly taxed, even under the indirect taxation of a protective tariff upon articles of consumption imported from abroad. The American cotton country, too, is intersected by great navigable rivers, affording the cheapest possible means of communication by steamboats and by barges. Added to this, the staple of the American, or more correctly, the Mexican seed cotton (which is of that quality known as New Orleans) is sufficiently strong to bear the action of what will be presently described as the saw gin, a machine for separating cotton from its seed at the rate of from two to seven bales per day. Hardly any other than the Mexican seed cotton will bear the saw gin, and hence, heretofore, no other staple could as a rule be so rapidly and cheaply ginned. As gathered from the shrub, the fine filaments of cotton are firmly attached, at one end, to a hard but oily seed, not quite so large as the kernel of a filbert. This seed is covered with cotton on all sides, and the value of this depends upon the length, fineness, strength, and colour of the filaments. These are flattened, twisted tubes, with no joints; whereas the filaments of flax are cylindrical, jointed tubes. Cotton fibres vary in diameter from the $\frac{1}{1000}$th to the $\frac{1}{1600}$th of an inch, or about one-third the diameter of fine human hair. Their length varies greatly. Inferior cottons have a staple not longer than $\frac{5}{8}$ths of an inch; the New Orleans middling variety is about $1\frac{1}{4}$in., while the very fine Sea Island cotton sometimes reaches a length of $2\frac{1}{4}$in., or even more. The short-staple cotton grows from a greenish-coloured seed, which, even after ginning, has a woolly surface, while the finer cotton, as the Sea Island, has a smooth black seed, from which the filaments are easily detached. Of a given weight as it comes from the field, only from one-fourth to one-third is cotton, the remainder being seed. From their great comparative weight, if for no other reason, the seeds must be separated from the cotton at the place of growth, as otherwise the cost of freight to market would be tripled or quadrupled.

It would be an intolerably tedious process to pick the cotton from the seeds by hand labour. Not much more than one pound of clean cotton, or lint, as it is always called on the American plantations, could be thus separated per day. From a very early period, however, the Hindoos have cleaned their seed cotton by passing it between a pair of smooth wooden rollers revolving nearly in contact with each other. This machine is known as the churka, and is still used in India. The rollers, by their revolution, draw the filaments of cotton between them and thus away from the seed, upon which, from its size and hardness, the rollers cannot bite. Smaller rollers of steel, fluted with fine grooves along their length, so as to increase their tractive force upon the filaments of cotton, are still made and used to some extent in separating Sea Island cotton from its seed.

The word "gin," as applied to machines, is a contraction of the word engine, and the churka is undoubtedly the most ancient cotton cleaning engine or gin in existence.

On the conclusion of the American war of independence in 1781, the people of the Southern States of the new Union turned their attention to the cultivation of cotton, for which the then increasing use of Arkwright's spinning machinery had already created a considerable demand at high prices. With a rich soil and congenial climate, and with the economy of slave labour, crops to almost any extent could be cheaply raised. But the separation of the cotton from the seed presented a great difficulty. Hand labour for this purpose was even then out of the question, while the churka, known in America as the roller gin, was so ineffective that two or three days' work of even forty slaves, each employed in feeding and turning a gin of this kind, would result in but a single bale of clean cotton, often the produce of but a single acre of land. Each slave labourer will cultivate cotton to the extent of five bales yearly on the uplands of Georgia, and from ten to fifteen bales on the lowlands, but it would require the constant work of the same labourer, at a churka, for nearly three months to separate even one bale of clean cotton from the seed. At the Royal Exhibition held last year at Turin, a large number of cotton gins, of all kinds then known, were carefully tested for quantity and quality of work. Among them was a churka made and in considerable use in Italy under the name of Manganello. With a pair of $\frac{3}{4}$in. wooden rollers 8 in. long, worked by one man at the rate of 89 revolutions per minute, only six ounces of cleaned Siamese cotton were turned out per hour, and probably not more than half a pound per hour from like gins could have been counted upon by the American planters in the last century. The Sea Island and the upland cotton were first planted in the States in 1789, but many planters who thus commenced soon abandoned this branch of culture. It happened at this time that a Yankee schoolmaster, Eli Whitney, then resident in the family of an influential Southern planter, had his attention directed to the then great want—that of a machine or gin for quickly and cheaply separating cotton from its seed. Whitney hit upon a revolving circular saw, as the most effective instrument for the purpose. Not that the saw acts by incision, as in its common application with wood, but its teeth, which are filed to the form of sharp conical claws, seize hold of and pull away the cotton from the seed, the seed being held back by the fixed sides of a narrow opening through which the saw is made to revolve, much as a circular saw, in wood working machinery, revolves between the sides of a narrow slit in the saw-bench. It is a little doubtful whether Whitney, at that time, had seen a circular saw in use for cutting wood, but had he done so, the whole idea of his gin might have been caught from such a saw at work. With a saw shaft once in revolution, it was evident that a number of saws might as well be mounted upon it, each working between the sides of its own guard, for stopping the seeds, and thus, it would be right to suppose, the effect of the machine would be directly as the number of saws employed. Whitney understood this, and he fixed a considerable number of saws at short intervals upon a single shaft, and these worked with but little clearance at their sides between the bars of a kind of a gridiron, or grid. A revolving cylinder with projecting brushes was added to clear the cotton from the saw teeth after it had been drawn through the grid. Whitney completed his invention and patented it in 1792, and it is impossible to say how much the cotton trade now owes to his simple and effective contrivance. The early machines turned out 300 lb. of clean lint per day, while at the present time a gin of sixty or seventy nine inch saws, driven by steam at a speed of 180 to 200 revolutions per minute, will deliver 3,000 lb. of clean cotton in twelve hours, an amount about equal to the average yearly crop cultivated by a single slave labourer. As an inventor, Whitney's fame in the States

is co-extensive with that of Fulton, and his tomb, at New Haven, Connecticut—modelled after that of Scipio, at Rome—bears a glowing eulogy to his genius.

When we consider the exceedingly delicate character of loose filaments of cotton, it is a matter of wonder that they bear the discipline of the saw gin at all. Indeed, it was soon found that the fine Sea Island cotton was cut to pieces in saw ginning, as the long-stapled Egyptian cotton, if it were tried, would also be. It is to the credit of the American or Mexican "Orleans" and Georgia staples that it does bear the saws. Other cottons, however, do not possess the same strength and elasticity. The indigenous Indian, Chinese, and Turkish cottons will not bear the saws, and they require careful treatment in any process of ginning. On the occasion of the International Exhibition of 1862, Mr. Wanklyn, a well-known Lancashire cotton spinner, sampled and valued all the cotton exhibited. Much of it had been spoilt—literally chopped to bits—in ginning, and a still larger quantity had been more or less injured, so as materially to lessen its value. The difference between good and bad ginning, as applied to the case of the whole present Indian cotton supply, would amount to a difference of between six and ten millions sterling in value yearly.

The American or Mexican cotton may be grown elsewhere, however, than in America. Its seed has been transplanted in Brazil, in India, and in some other countries. The New Orleans seed was introduced into India in 1842, by Mr. A. N. Shaw, the collector in the Dharwar district of the Bombay presidency. At one time the result was reported a total failure, and this report appeared under Government auspices. It is the fact, however, that Dharwar cotton, of all others in India, is the most extensively cultivated, while it brings also the highest price. It is believed by many that the New Orleans seed has degenerated since its introduction into India, yet Dr. Forbes Watson's reports show that much of the Dharwar cotton has a staple of from $1\frac{1}{4}$in. to $1\frac{1}{2}$in., and, in some cases, even $1\frac{7}{10}$in. long, and of a very fine quality. All the Dharwar cotton is saw-ginned, after the American practice, and it is believed to be the only Indian-grown cotton that will bear the saw gin. Dharwar, although in the Southern Mahratta country, and near the Madras Presidency—in fact, not many miles to the eastward of the Portuguese colony of Goa—is commonly reckoned, in respect of its production of cotton, with the district supplying what is known as Surat cotton, or Surats, from the port of that name to the northward of Bombay. "Surats," in Lancashire, has become a term indicative of everything bad, from beer to theology. Indeed, one of the Manchester newspapers, not long since, incurred and lost an action for slander, in consequence of the unintentional admission of an advertisement, in which the produce of a firm of brewers was spitefully nicknamed "Surats." Much short, yellow, weak-stapled cotton, filled with leaf and stones, has undoubtedly been shipped under this name from Bombay to England; but the Dharwar cotton deserves a different classification. With proper means of communication it is probable that the cotton of the Dharwar and other districts of the Deccan will be yet shipped from the new port of Sedashagur, nearly half-way between Bombay and Beypoor, the latter being the western terminus of the Madras railway.

Without entering fully into the moot question whether exotic cotton will thrive permanently in the East, it is nearly certain that the Dharwar, or transplanted staple, is the only one now in India which can be saw-ginned without much loss by cutting, and without the formation of knots or "neps" of fibres, which sadly try the fine teeth of the carding engines, and which if once produced in ginning, will infallibly cause the production of lumps in the yarn. The American cotton has this advantage, also, in favour of the grower: with a given crop of seed cotton, requiring a given amount of labour in its cultivation, from three-tenths to one-third are obtained as clean lint, whereas nearly all other short-stapled seed cottons give one-fourth only of their weight in lint. In other words, the American seed, on Indian soils, gives nearly one-fourth more clean cotton, for the same acreage and labour, than any of the indigenous sorts.

The Macarthy gin, as it is named from its Irish-American inventor, who produced it about thirty years ago, was designed for staples that are too tender to bear the saw-gin. Its action is at once simple and unique, and it may be described as that of rubbing the fibres from the seed, or, more strictly, pulling them from the seed by a rubbing process. The construction and action of the Macarthy gin will be better understood, perhaps, from a familiar illustration than from drawings and a technical description. The roller of a jack towel, revolving nearly but not quite in contact with a kitchen wall, will convey the idea very closely. And, without wishing to make out a case for the interference of the Society for the Prevention of Cruelty to Animals, a Skye terrier will serve as a magnified as well as animated representative of the seed, with its cotton growing from all parts of its surface. With so much suggested it is easy to understand how a mischievous boy would proceed to gin a favourite poodle, and if the poor brute were not fleeced, and possibly flayed in the operation, he would have nature and not his tormentor to thank for it. But if we pursue this illustration we shall see that, if the roller were sufficiently large and turned with sufficient force, it would "bite"—to use the technical term—not merely the hair but the dog also. So, instead of the kitchen wall, we will place the edge of kitchen shovel along the roller, so as nearly to scrape its revolving surface, this edge being presented not towards the centre of the roller, but tangentially to its circumference. If, now, we cover the towel roller with leather, so as to increase its frictional power, we shall have the Macarthy gin. The revolving leather-covered roller pulls the cotton through the narrow space which separates it from the fixed tangential blade, or "doctor," as it is called, and the seeds are kept back because they are too large and too hard to pass through. The action may be compared to that of the churka, although there is some difference. The advantage which the Macarthy roller has over the churka is that the former may be made of any convenient diameter, and thus its surface speed may be increased much beyond that of the small rollers of the churka; and, furthermore, as the larger roller has sufficient stiffness to prevent springing sideways in its work, it may be made of any convenient length—say, 20in., or even 40in., whereas, the churka rollers are seldom more than 8in. long.

In addition to the fixed blade of the Macarthy gin there is a second blade parallel with it, and put in rapid motion, so as to alternately overlap its edge, and thus to roll the seed cotton about, so that every portion of its surface may be fairly brought to the fixed edge of the "doctor." A grid is provided, of such width of opening that the seeds can only pass through it and escape after they have been completely stripped of their cotton.

Different makers have added various parts to the Macarthy gin, until, in some cases, it has become a complicated and a costly machine. One of these, in the International Exhibition of 1862, with a profusion of rollers, wheels, &c., representing an accumulation of alleged improvements, was said to turn out about 40lbs. of clean cotton per week for each inch of the length of the roller, or, say, 1,000lbs. of cotton for a 24-inch roller. The delivery of cotton depends upon the quality under treatment, and twice as much Sea Island, or even Egyptian cotton, could be ginned in a given time as could be turned out with Syrian or the shorter-stapled Indian sorts. At the Exhibition held last year at Turin, a large number of gins, of different kinds, and mostly by English makers, were tested with great care. The report of the Commissioners charged with the experiments gives the dimensions of the several gins, the speed at which they worked, the quantity and kind of seed cotton ginned,

the quantity of seeds and clean cotton delivered, the temperature of the air at the time, the hygrometric state of the cotton, &c.; and also the power expended, as ascertained in the case of the steam-gin, by means of a dynamometer. The results were so widely various as to defy the application of any law; but it may be said that the very best, in the case of a gin with a single Macarthy roller, 5in. in diameter and 40in. long, worked at the rate of eighty revolutions per minute for only fifteen minutes, was at the rate of rather less than 22lbs. of cleared Italian cotton per hour. Another trial of the same gin, at the same speed, for eleven minutes, gave a rate of 18lbs. only of cleared cotton per hour. A gin of the same size, by another leading maker, and worked at the rate of 125 revolutions per minute for 14 minutes, delivered at the rate of $14\frac{1}{10}$lbs. only of cleaned cotton per hour. As a rule the shorter rollers—say, 20in.—gave a better result in proportion to their length, because, no doubt, the labour in feeding, being applied to a shorter distance along the roller, was relatively more effective. In one case a gin, with a $4\frac{1}{2}$in. Macarthy roller, 40in. long, driven, in successive trials, at the rates respectively of 73, 138, and 107 revolutions per minute, turned out cleaned cotton at the hourly rates, respectively, of $1\frac{4}{10}$ lb., 12 lb., and $8\frac{1}{3}$ lb. only. If anything like an average result could be drawn it was that the gins with a single Macarthy roller did not average over 5 lb. or 6 lb. of clean cotton per hour, at which rate it would take more than a week to gin a bale of cotton. The Macarthy gin does its work well so far as the condition of the clean fibre is concerned, and, were it not that its action is so tedious, and therefore so costly, a great aggregate saving would be effected by ginning even American cotton upon it. But this is totally out of the question, for if a penny or so per pound were thus added to the value of cotton, this would be more than lost in the greatly increased cost of ginning as compared with the saw gin. The Macarthy roller, too, is constantly wearing out, and has to be covered anew every few weeks, at a cost from £2 to £4. The leather frequently strips off at once from the wooden roller, and it is especially liable to deteriorate in hot countries. To avoid these difficulties finely-grooved iron rollers have been employed, the grooves running spirally around the roller. But these are not found to answer well, although they are, no doubt, very durable. In other cases rollers formed of circular discs of paper, compressed with great force upon each other, are in use, although here the frictional power or tractive force upon the cotton is less than that of leather. Indeed, the proverb appears to have held good, that "there is nothing like leather" for the rollers of the Macarthy gin. The tremor caused by the rapid movements of the vibrating knife, worked by a pair of short cranks, making from 500 to 700 revolutions per minute, is an objection to the gins now generally made upon the Macarthy principle. The vibrating knife, too, in many cases, interferes with instead of assisting the access of the seed cotton to the ginning roller. This was remarked upon in the case of several of the gins worked at the Turin Exhibition. Again the feeding requires constant attention, and, even at the best, it is irregular. The cotton cannot, of course, be expected to come off in an even fleece, like the thin and beautiful web from the doffer of a carding engine, but, very far from this, it ordinarily leaves the Macarthy roller in lumps and patches, falling irregularly both as to time and as to the length of the roller. Thus although the whole quantity ginned may be but little, too much may get through at one point, heating the roller to such an extent as to destroy the leather.

The last annual report of the committee of the Cotton Supply Association observed, as to the cotton gins, that "much yet remains to be done to provide what is urgently needed, to wit, a machine which, without injuring the staple as the saw gin often does, shall approximate to it in productive capability. Your committee regard this as a matter of vital importance to the cultivation of cotton." This opinion of the committee is that of every person well informed upon the subject. It is already a matter of much complaint that even the Dharwar cotton in India, the only kind grown there that will bear the saw gin, is being spoilt by the ryots who plant the indigenous and the exotic seed together, the result being a mixed staple, perhaps half of which is so injured in saw ginning as to render the whole nearly worthless. Whatever, too, may be the case of Indian cotton cultivation at present prices, anything like a return to those which prevailed five or six years ago will depend upon a very great improvement in gins. As applied to the prospective cotton crop of India, the advantage of a gin which, while nearly as efficient as Whitney's, shall make as good work as Macarthy's, may be valued at ten millions sterling per annum, or, if capitalised at ten years' purchase, to one hundred million pounds. This is but a practical and reasonable estimate of that which the committee of the Cotton Supply Association consider, to use their own words, "a matter of vital importance to cotton cultivation."

So long as ginning is a mechanical operation (and it has not been yet proposed to employ chemical agencies in the separation of cotton from its seed) so long must the staple be forcibly pulled from the seeds, which must be held back by the narrowness of the space through which the staple is drawn. The clawing action of the saws, the direct pull of the churka, and the rubbing pull, if the term may be allowed, of the Macarthy roller, would appear to exhaust all the modes in which force can be properly applied for the purpose to seed cotton. It is not certain what improvements, if any, can be made upon the saw gin. Certain modifications have been made, but the saws, to which all the injury to weak staples is attributable, are still the same in all gins of this class. A far more likely direction in which to look for improvement would be in that of the Macarthy gin, and here, it is not now premature to say, an improvement has been lately made which appears likely to raise this class of gins to the position contemplated in the extract quoted from the report of the Cotton Supply Committee. It is easy to see, on looking at a Macarthy roller at work, that a great portion of its surface, perhaps 40in. wide and running at the rate of 150ft. per minute, is altogether ineffective. Where something like an unbroken cascade of cotton should fall from it, it delivers in driblets. This scattered and patchy delivery proves that the appliances for feeding the roller are not what they should be; and this fact is a matter of course where constant hand feeding is required, as in nearly all the gins heretofore made of this kind. The travelling lattice and feed rollers sometimes employed do not act with anything like the effect on seed cotton that they do upon the cleaned staple in the opener, or the lap in the carding-engine. Seed cotton has very little cohesion in the mass, and it objects to march in close rank up to the sharp blast of the ginning roller. But by urging it forward, and distributing it continuously along the whole length of the fixed blade, the tractive force of the leather-covered roller may be increased, perhaps, four or five-fold beyond the ordinary rate. These objects appear to have been fully accomplished in the new gin invented by the gentlemen of the North Moor Foundry Company of Oldham, Messrs. Brakell, Günther, and Hoehl. In addition to the Macarthy roller and fixed blade or "doctor," they employ what is called a "knife roller," revolving in an opposite direction to the ginning roller, and at about four times the velocity. The knife roller, of which an example is shown, is a stout tube of gas pipe, with journals at the ends, and having upon it a number of discs or washers, placed obliquely to its axis. As the knife roller is rapidly revolved these discs not only draw the seed cotton into the ginning roller, but they distribute rapidly and alternately to the right and left along the edge of the "doctor." The knife roller is of the same diameter as the ginning roller, and the oblique discs or washers upon the former are from $1\frac{3}{4}$ in. to 2 in. apart, and have such an obliquity, with reference to the axis of the roller, that

the whole of the seed cotton is rapidly traversed right and left along the doctor to about the same distance of $1\frac{3}{4}$ in to 2 in. From the form of the oblique discs the change from the right to the left-hand motion, and *vice versâ*, although made at very short intervals, is, nevertheless, gradual. The whole improvement consists in the application of the simplest possible means to produce a constant in-draught of seed cotton, and to distribute it constantly along the ginning roller, all parts of which are thus made to do their share of work. Instead of arguing, however, as to what the action of the knife roller ought to be, it is better to give the results actually obtained in practice. With a ginning roller twenty inches long the author has worked the knife roller gin with the following results:—At 152 revolutions per minute of the ginning roller, at which there was but the slightest heating of the leather coverings, the rate of cleaned Syrian short-stapled cotton delivered was 28lbs. per hour. Of African cotton, of a slightly better quality, the rate was 31 lbs. per hour. Of Egyptian cotton, with hard black seed, the rate was 45lbs. per hour. These rates may be taken as quite double that attained by any other gin of the same dimensions on the Macarthy principle. The seeds were very thoroughly cleaned, showing no waste; the fibre was not cut or torn in any manner, and, indeed, there was nothing to tear it. Nor was it at all knotted into those obstinate little entanglements which the Manchester spinners call "neps," and which, while they throw the teeth of the carding engines out of pitch and out of shape, and give, perhaps, fifty different diameters to a single yard of yarn, cause sad infractions of proper language among the spinners themselves. To turn out a large quantity of clean and uninjured cotton without waste is all that is expected of the best gin, and this the new knife roller gin undoubtedly accomplishes. It is, moreover, of extreme simplicity, having but three wearing parts—the ginning roller, the knife roller, and the "doctor," with but a single pair of spur wheels to gear the two rollers together. The usual objectionable cranks and rapid vibratory motions are altogether dispensed with. The gin is self-feeding, in virtue of the action of the knife roller, and thus a single attendant can manage a number of gins.

These results are confirmed by many of the leading mechanical engineers and cotton spinners of Lancashire who have seen the new gin at work, and the results stated may, therefore, be considered as accepted by those responsibly engaged in those branches of trade connected with the manufacture and working of cotton gins.

The makers of the knife roller gin have also produced what promises to be an improvement upon the Macarthy roller. Instead of a plain roller with a leather jacket, they have formed a compound roller of alternate discs of leather and malleable cast iron, the latter smooth on their circumference, but having corrugations on their sides near the edge. This roller appears calculated to exert a greater average tractive force upon the cotton, and to be more durable than the rollers now in use, and it is not likely from its action to injure the staple. Whether further trial should or should not fully confirm these expectations the novel and excellent action of the knife roller is not less established, and to this alone the great superiority of the new gin may be attributed.

Efforts are now making to grow cotton wherever it can be cultivated with the prospect of fair and good crops. As a great textile staple, cotton must be always in demand, and just as this demand is met so must the price fall until only a fair price is realised on the prime cost of production, with a due interest on the capital invested. As the price of cotton falls the relative importance of cheap and expeditious ginning will increase. With cotton as now at from 18d. to 2s. per pound for middling staples, even a penny a pound, as the cost of ginning, is not relatively large, but with anything like a return to 6d. per pound even $\frac{1}{2}$d. for ginning would be a very serious item in the total cost. As one means of improving the general condition of the Indian cotton trade, therefore, and of enabling it to hold its own, permanently, against competition from all other sources, the author has brought to the notice of the Society of Arts what he believes to be the best instrument yet contrived for ginning cotton. When once this conviction is shared by this Society, perhaps no other agency than theirs could be more effective in making known the truth throughout the great cotton producing districts abroad. At the present juncture no subject is perhaps more worthy serious consideration on the part of the council and members of this Society—especially charged with the duty of encouraging the arts and manufactures—than that of the cheap and perfect separation of cotton from its seed—a matter upon which the permanent prosperity of the Indian cotton trade in a very great measure depends.

DISCUSSION.

Mr. Varley remarked that the comparison made by Mr. Colburn between the fibres of cotton and flax was incorrect. It was stated that the filaments of cotton consisted of "flattened twisted tubes, with no joints, whereas the filaments of flax are cylindrical, jointed tubes." He submitted that there was no joint whatever in the fibre of flax, the apparent joint being only a cross filament. Many years ago an attempt was made to "cottonise" flax by soaking it in alkali, and afterwards in acid; but the process damaged the material. Experiments he had made with filaments of flax, showed them to be neither tubular nor jointed, but quite solid. He believed flax to be the best material for the manufacture of cloth.

Mr. A. Nesbitt Shaw said, his name having been mentioned in the paper, he requested permission to say a few words on this subject. With respect to the question of gins generally, the first consideration was to adapt them to the particular kind of cotton on which they were intended to operate, as it was obvious from what was stated in the paper that the description of machine which was adapted for one quality of cotton would be injurious to another. Without going through all the different varieties of cotton, he would divide them generally into the two kinds of green seed and black seed cotton. Amongst the latter might be classed all the indigenous cottons of India. Hitherto they had been unable to introduce the better qualities of cotton into India without the aid of irrigation. These were perennial, and no doubt, with the aid of irrigation, would yield three or four good pickings a year. He considered if the Government of India had done its duty the better qualities of cotton would have been cultivated in that country to a very much larger extent. The New Orleans was the only exotic cotton grown in India as an ordinary crop; and in speaking of the relative commercial value of New Orleans and indigenous cotton, he might be allowed to quote a few sentences from a paper on this subject which he read two years ago before this society, in which he stated:—

"New Orleans still maintained its position at the head of the price current, being on the 12th of November, 1862, 150 rupees per candy higher than the best cotton in the Bombay market. . . . Allowing that it requires seven acres of the New Orleans seed to produce a candy, or 784 lbs. of clean cotton, and that thirteen acres of the indigenous cultivation are necessary to yield an equal amount (the relative prices of the New Orleans and indigenous cottons being as quoted in Bombay at the above date, 560 rupees and 390 rupees per candy), the difference of the value of 280,000 acres of these respective cultivations, taking the rupee at two shillings, would be as £2,240,000 to £840,000, leaving in favour of the New Orleans £1,400,000, to be divided amongst those concerned in India in growing and selling the crop, and manifold more valuable to the Government and country than the whole aggregate of the expenditure which has been incurred in all the experiments throughout India."

Looking at this statement, it was obvious that the cotton to be introduced into India was the New Orleans; and in the South Mahratta district there were very nearly

half a million acres of that cotton now under cultivation. It was well know that during the old time of the monopoly of the East India Company very little cotton came to this country from India. What they could acquire through their agents was bought up and sent to China in exchange for tea. They might have introduced every description of cotton into India if they had desired it, but under the monopoly of the East India Company they neglected to do so. After that monopoly was broken up, the manufacturers of Manchester took up the question, and frequently urged the East India Company to improve the quality of cotton grown in India, seeing that the trade had fallen completely into the hands of the Americans. Under that pressure the East India Company did what they no doubt conceived was right. They established large cotton farms in several districts, particularly in Dharwar, and they sent out some gins, in the first instance, for the purpose of cleaning the cotton. After several years of this experiment, in 1835, instructions were sent out to abandon the cultivation of New Orleans cotton altogether, and, as far as the Company was concerned, we should thus have been hopelessly condemned to the indigenous cotton of that country. This did not, however, satisfy the manufacturers of Manchester, and they resolved to make another attempt, and, accordingly, they sent to the United States, and engaged a number of Americans to go out to India; at the head of them was placed a military officer, not practically acquainted with cotton matters, and many of the rest were equally incompetent. In the meantime the experiments to which Mr. Colburn had alluded were undertaken. He (Mr. Shaw) took little credit to himself in the matter, but he was the first person who introduced the New Orleans cotton into India as an experiment, and it succeeded. After the first year he applied to the Government for assistance in extending the cultivation of that quality of cotton, but it was refused, on the ground that all the previous experiments had failed, and that it was useless to give further aid to promote that which they were satisfied would not succeed. However, the experiments went on, and the cotton was pronounced to be as good as any grown in the United States, but it was found that the old saw gin was useless for cleaning that cotton; a number of saws were sent out by the Company, and fitted up in rude machines by native blacksmiths. The only appliance previously was the native churka, a very rough instrument, and the only wonder was that cotton could be cleaned with it at all, except that the black seed cotton was hard and smooth, and easy to separate from the seed, but when applied to green seed cotton the fibre was greatly bruised and damaged. It was, therefore, necessary that there should be great improvements made in the mode of cleaning cotton in India. If India was to compete successfully with the American States in the growth of cotton, a quality of cotton such as that grown at Dharwar must be introduced. It was incredible the number of applications that had been made to the Indian Board for assistance in relation to this object. The aid required was not of a pecuniary character, but merely that the Government should place in each cotton-growing district of India men who thoroughly understood the cultivation of that plant, and who could induce the natives to act upon the advice given them, so as to make the New Orleans cotton popular amongst them. The reply to deputations on this subject invariably was, "It is not the duty of the Government to interfere; go to India yourselves and grow cotton there." He submitted it was emphatically the duty of the Government to interfere in this matter. Seeing that they had given a guarantee of five per cent. to an enormous capital expended in carrying out railway communication to India, for the purpose of opening out the resources of that country, was it too much to call upon them to promote the growth of cotton there? He contended the Government had lost the greatest opportunity they ever had of competing with the American States in the cultivation of cotton; and whenever the war in America terminated, India would fall back, in respect of the cotton question, into the position which it occupied ten years ago; but, on the other hand, if what had been done in the Dharwar district had been done throughout India generally, England at the present moment would have been independent of America for her permanent supply of cotton.

Mr. James Garside trusted that the forebodings of the last speaker with respect to the cotton question in India would not be realised. He (Mr. Garside) took a more hopeful view of the case. There had been some confusion in the use of the term Surat cotton. The so-called Surat cotton was grown in Goozerat, which was the district from which they might look for the main cotton produce of India. The bad name acquired by that cotton he believed was mainly owing to its unscrupulous adulteration, but that was not the fault of the gin employed. In India they had the native gin, the American gin, and the gin combining the recent European improvements. There was another machine employed by the natives besides the churka, the work done by which was excellent, though the process was a slow one. One great want of India was an efficient churka or hand gin, so as to afford employment to the large surplus female population of towns in India. The cotton question was now entering upon an entirely new phase. Up to the present time the profits of the cotton cultivation of India had been derived by the native agents rather than by the growers; and there could be no question that for the last three years great advantages would have been gained in every respect if the English manufacturers had been brought into more immediate contact with the ryots, so as to buy the produce directly from them instead of through native agents. The real secret, with regard to the cotton question in India, was the obtaining of a fair remuneration by the growers for their produce, and a permanent and safe market for it. That could be effected by no better means than by the establishment of some half-dozen substantial farms by Englishmen in the principal cotton districts. There was no difficulty in dealing with the ryots; and in proportion as good faith was established between them and the buyers, and as they were assured that there was a safe and permanent market for their produce, so would be the increase in the extent of cotton cultivation. In speaking of the peculiar adaptability of the Goozerat district for the growth of cotton, Mr. Garside remarked that the prevalent belief was that a great portion of that district was the base of an ancient fresh-water lake, containing vast deposits of vegetable matter. Here cotton was grown without artificial irrigation. A still more important matter than the gin, with regard to India, was the proper selection of the soil. Without that they could never get good staples. Looking at the specimens in the India Museum, the cotton was of better quality 150 years ago than it was at the present time. Formerly, Surat was the Liverpool of India with regard to the cotton produce of the country. The Indian ryot only required the certainty of the English market to stimulate him to the production of large quantities of cotton; but whilst they had the melancholy prospect held out in the speeches and writings of such men as Mr. Cheetham and Mr. Ashworth, that it was useless to think of growing cotton in India for the permanent English market, they could not hope that the vast resources of that country would be employed to anything like an adequate extent in that direction.

Mr. Bazley, M.P., would divide the few observations he should offer on this subject into two points; first, the necessity of obtaining a good quality of cotton; and, secondly, the necessity of its being well prepared for the market. His friend Mr. Shaw had given the meeting an account of the origin of the growth of the superior cotton of the Dharwar district, but Mr. Colburn had inadvertently fallen into an error in supposing that the chief part of the cotton sent to this country from India was of the Dharwar class; that class constituted only about one-

tenth of the cotton that came from India. Of the great productiveness of that district in the cultivation of cotton, however, there could be no question. It would be, no doubt, a difficult task to overcome the prejudices of the natives in favour of the indigenous seed, and bring them to cultivate the superior quality of American seed, and in that respect undoubtedly good service had been rendered by the personal exertions and encouragement of Mr. Shaw. The native cotton dealers were in the first instance so prejudiced in favour of the indigenous produce, that it continued for a long time to command a better price at Bombay than the superior staple produced from the American seed; and it was not until the opinion of the English manufacturers was evinced by the larger price which the Dharwar cotton brought at Liverpool, that these prejudices were removed. It was gratifying to find that as the civilization of the people of India progressed under European government their long-retained prejudices were being rapidly removed. In no respect was this more apparent than in the matter of prejudice of caste. At the present day people of all castes travelled together in the railway carriages, where formerly they would not have been found in the same house together. It happened that the party of Americans Mr. Shaw had alluded to, as having gone out to India to improve the cotton cultivation, passed through Manchester, and he had the pleasure of showing them a fine crop of cotton plants, flowering, growing in an attic story of one of his large cotton mills. The production of cotton was not merely a question of seed, but also of soil and method of cultivation. The cotton plant required a loamy soil with an admixture of sand, with a looseness and moisture that would enable the roots to penetrate two feet into the ground. It was frequently planted on such hard soil that it could not obtain the necessary nutriment. A great many of the British colonies, such as portions of Australia, the West Indies, and some parts of our African possessions, were exceedingly well adapted for the production of large quantities of cotton. He thought it was a disgrace to us as manufacturers that we had allowed ourselves to remain so long dependent upon the slave-grown supplies of cotton from the States of America. About fourteen years ago, he had the honour of giving a lecture on this subject in that room, on which occasion the lamented Prince Consort did him the honour to preside, and he then called attention to the great danger of our reliance upon the fragile support of slave labour for our supply of this important staple. If the course indicated by Mr. Shaw had been pursued, no doubt by this time we should have been independent of the American States in this respect, and the amount of suffering which had been experienced in Lancashire would have been avoided. It was most important that the natives of India should understand that we want cotton of long fibre and sent to market in a well prepared state fit for the manufacturer's use. But the fact was the grower of cotton in India was not paid a price according to the quality of his produce. Good and bad qualities stood almost on the same footing; the cotton-grower therefore required to be taught the value of superiority of quality; and if he were made to understand that a higher price would be given for cotton of the staple of an inch than for that of a quarter of an inch, he would make efforts to supply that which was wanted. In all probability there would be a considerable re-action with regard to the cotton cultivation in India, upon the re-opening of the American supplies to this country, unless the system of cultivation in India was placed on a firmer and more satisfactory footing. He deplored the loss of opportunity by the Government of India in stimulating the production of the higher qualities of cotton at a time when the price of that article was so enormously high. Last year the amount of money transmitted to India by our manufacturers for the cotton produced there was, at the present high prices, so large that India was an important gainer by the transaction. If the price of cotton fell to its normal figure, India would be the loser to a considerable amount; but if the cotton was of that high class it might have been made, the loss would be greatly diminished, as the price would be higher. He had seen cotton of every class from India, and he believed they might have from the most generally useful class, which was New Orleans, up to the finest Sea Island—all the produce of India—if proper efforts had been made to obtain the cotton we want. With respect to the cleaning of the cotton, unless the article was good in itself, no mechanical operation would ever make it fit for the manufacturer's use. The Indian churka had, probably, been in use nearly 2,000 years, and it was a singular fact that the finest samples of Sea Island cotton from the American States were prepared by the roller gin, which was a machine very much upon the principle of the ancient Indian churka. The Whitney gin was applicable to short staples only. The length of the New Orleans was on an average only about three quarters of an inch. It was not merely from the superior toughness of the New Orleans fibre that the saw gin did not injure it, but from the length of the staple, which permitted the teeth of the saw to pass over it without injury. The staple of Sea Island cotton was from $1\frac{3}{4}$ inch to 2 inches, and although the fabric was strong, yet if, owing to its length, it got into loops, the teeth of the saw tore these apart, and injured the staple to the extent, in his opinion, of 10 per cent., which, on a large crop of cotton, made a very serious item. For this reason he hoped to see the saw-gin superseded by the roller-gin. The Macarthy roller gin was brought into this country, a few years ago, under somewhat curious circumstances. Some Sea Island cotton was sent over prepared by this gin. It had a most beautiful fleecy appearance, almost like a mass of snow, and he (Mr. Bazley) was so pleased with the condition of this cotton, that he wrote to his agent, at Charleston, to send him one of these Macarthy gins. In due time it arrived, and he had a number of them made by merchants in different parts of Lancashire. The machine now before them was an offshoot of it. By the aid of that gin he had no doubt there would be great economy in the preparation of cotton for the spinner, and the yarn made from that cotton was in many respects superior in quality. Economy in the separation of the fibres was of great importance. If 5 per cent. of cotton were left on the seed it was a loss equivalent to the amount they paid for cleaning the cotton. This ought not to be in itself an expensive operation. A good saw gin would produce 2,000 lbs. of cotton a week, worked with wind or water, and attended by a couple of negroes. The Americans were very clever in the use of the saw gin, and by ingenious modifications they had reduced the amount of injury to the fibre to a minimum. They wanted skill applied to the cultivation of cotton, and good machinery for cleaning it. There was one difficulty referred to connected with the introduction of large quantities of Indian cotton into this country—viz., that the English manufacturer could not place himself in direct communication with the planters. In America a different state of things existed, owing to the large number of agents employed there, to whom the criticisms of the manufacturers were conveyed, and by them transmitted to the planters; so that the English spinner could, as it were, almost bespeak the precise nature of the article he required. A striking contrast in this respect existed in India. As manufacturers they had no knowledge whatever of the cultivation, but if they could have agents to stimulate the growers to produce better cotton, he believed the regeneration of cotton cultivation in India would be accomplished. He was more and more convinced that the proper stimulus to all exertion—viz., a due reward for it—was all that was required to produce results alike beneficial to this country and to India.

Mr. Bishop mentioned that in travelling through Syria and the Holy Land he was surprised to find what a large amount of really good cotton was spoilt by the use of a gin even worse than that employed by the Chinese.

Having described the construction of that machine, he added that he had seen thousands of them at work in Syria. The great outcry in that country was to get a proper machine for cleaning the cotton; but it appeared that no European had ever introduced any improvements upon the primitive method still employed there. With respect to any improvement in the quality of the cotton, he learnt that one grower had been induced to try a better kind of seed, which he planted in a small patch by the side of the native cotton. He was highly delighted with the result, and for a long time kept the fact of his having this new seed a secret. The inquiry consequent upon a better quality of cotton was naturally for a better machine to clean it with. Throughout the whole district of Lebanon, to the river Jordan and the Dead Sea, the growth of cotton had greatly increased, and from inquiries he made he ascertained that the produce last year was sixfold that of the preceding year. He was persuaded that considerable quantities of cotton might be obtained from Syria, if proper means were taken for that purpose. With regard to quality, he believed it was of a description that would generally meet the requirements of our manufacturers, and that it could be sold at 7d. per pound, to yield a profit of 30 per cent. to the grower.

The Chairman said he was sure the meeting would cordially agree in a vote of thanks to Mr. Colburn for his valuable paper.

The vote of thanks having been passed,

Mr. Colburn, in acknowledging the compliment, said that although it was of the utmost importance to get a good supply of cotton, he regretted that on this occasion the discussion had tended almost entirely in this direction, and had not sufficiently referred to the best sort of gin for cleaning it. He thought, however, enough had been said by Mr. Bazley to show the importance of good ginning. looking to the fact, as stated by that gentleman, that 10 per cent. of economy was gained by the Macarthy machine, which, on the average amount of cotton supplied to this country, would amount to no less than £8,000,000 per annum. The only difficulty with respect to that gin was the comparatively small amount of work it turned out, but he believed the new gin, to which attention had been called, did its work quite as well as the Macarthy, at the same time producing a larger quantity of work. It was, in fact, the Macarthy gin with considerable improvements, and he believed it accomplished nearly as much work as the saw gin.

A collection of various forms of cotton gin belonging to the Society was on the table, and at the conclusion of the discussion, Mr. Colburn showed the operation of the new gin referred to in his paper.

Proceedings of Institutions.

Glasgow Institution.—The sixth annual report says that, although the directors cannot report an increase of students, there has been no decrease in the acquirements and progress of the students and scholars receiving instruction in the Institution. The numbers who attended each class during the year are as follows:—Mathematics, 26; free-hand drawing, painting, &c, 30; mechanical drawing, 33; practical mechanics, 21; Latin, 40; Greek, 12; French, 54; Gaelic, 5; grammar, composition, and logic (English history as exercises), 112; arithmetic and book-keeping, 141; writing, 29; geography, 4. Morning classes: — Arithmetic, book-keeping, &c., 23; phonography, 16; elocution and English literature, 38; music, 6. Elementary evening classes (males), 79; ditto, and domestic economy (females), 26; ditto, advanced (females), 19. Juvenile day classes, 223. Select day classes, 16. Advanced day classes: — Mathematics, French, Latin, book-keeping, &c., 13; free-hand drawing, 133; needle work, 27. From 20 to 30 per cent. of the above attended two or more classes. The number on the evening-class list was 623, on the juvenile day-class list 223. The total number, therefore, who have received instruction in the Institution during 1863-64 has been 846. The number of certificates and prizes awarded by the Society of Arts to students of this Institution during the last four years, show how meritorious has been the work of its students. Of the whole number who came forward only ten were rejected; indeed, the Institution stands among the first for having few rejected. During the same time the Local Board has awarded 274 certificates for qualifications in the various branches taught in the Institution—these are given instead of prizes. The directors earnestly impress upon the students the great value of whatever tests or attests their qualifications, especially the certificates of the Society of Arts. They are of opinion that, were the Society to authorise certain initials to candidates who pass a successful first-class examination in a stated number of branches, it would add greatly to the value of the certificates, and also be a more powerful stimulant to the acquirement of education. The financial statement for the past year shows that the class fees amounted to £303.

FRANCE AT THE DUBLIN EXHIBITION.

In all the more attractive and decorative classes of objects, there will be a fine display from France at the International Exhibition. The Emperor himself heads the list with a splendid collection of porcelains from Sevres, and tapestry from Gobelins and Beauvais. Promises have also been received from Barbedienne, of bronzes; Barbezat for iron-work, and Thenard for silver-work. Musical instruments will be exhibited by Alexandre, Saxe, and Herz; laces by Lefevre and Ferguson; silks by Berteaux, Brunet, Lecompti, and many others. Furniture and all the *articles de luxe*, for which Paris is the head-quarters, will be well represented. The French department of the Exhibition will be in one of the most advantageous parts of the building, and the exhibitors are sparing no expense to render this department attractive and ornamental.

Fine Arts.

Exhibition of Portrait Miniatures.—The following minute has been issued by the Committee of Council on Education:—My Lords read a memorandum on a proposed Exhibition of Portrait Miniatures prepared by Mr. Samuel Redgrave, and consider it desirable that the proposal should be carried into effect. The Exhibition will be opened at the South Kensington Museum, on the 1st June, 1865, subject to the usual regulations of the Museum as respects loans of objects. Several noblemen and gentlemen are to be requested to give their aid as a committee to advise their lordships on the subject. Mr. Samuel Redgrave is to be requested to undertake the special charge of carrying out this minute. The following are the particulars of the proposed Exhibition:—1. The miniatures which formed a section of the Loan Collection in 1862, were objects of so much interest that it is proposed to give a further development to an exhibition of this art, in which English artists were the first to excel, and which, though now seldom practised, flourished in England for nearly three centuries. 2. The Loan Collection comprised chiefly the works of our early miniaturists, Hilliard, Isaac and Peter Oliver, and Cooper (which were endowed with an antiquarian interest), with a few by Cosway, R.A., and some other artists. But the object of a second collection, though not confined to the productions of English miniaturists, should especially be to make a representative exhibition of their works, identified with their, in so many instances, almost forgotten names. 3. In seeking the assistance of the collectors and possessors of miniature art, they should therefore be particularly solicited to state, as far as it is possible to do so

authentically—first, the name and titles of the person represented, and the date of the portrait; second, the Christian and surname of the artist; and third, the birth-place, date of birth and death (where not commonly known), with any other particulars that may prove of interest. A request should at the same time be made that such persons will kindly point out any other persons who possess miniatures which it is probable they will lend for exhibition. The collection might be completed so as to open some time in June next, and should include miniature portraits—first, in enamel; second, in oil and in water colours; third, in chalk or in pencil, whether drawn on vellum or paper, in plumbago solely, or in the latter manner with the face tinted. The following by no means exhaustive list, contains the names of many of the artists who practised in England, and whose works should be sought out and solicited for exhibition:—Miniaturists of the sixteenth century—Hans Holbein, John Bettes, Thos. Bettes, Nicholas Hilliard, and Isaac Oliver. Miniaturists of the seventeenth century—John Hoskyns, Peter Oliver, Samuel Cooper, Alexander Cooper, George White, Thos. Flatman, Alexander Brown, Thomas Sadler, Jean Petitot, William Faithorne, Sir Balthasar Gerbier, Richard Gibson (the dwarf), William Hassell, Sir R. Peake, Thomas Forster, Theodore Russell, Mary Beale, Penelope Rose, David Loggan, and Robert White. Miniaturists of the eighteenth century—John Dixon, Charles Boit, A. Plimer, Lewis Crosse, James Ant. Artaud, James Deacon, Bernard Lens, Thomas Frye, John Heens (of Norwich), William Blake, John Kitchingman, Thomas Worledge, John S. Liotard, Nathaniel Hone, R.A., John Cabaliere, Charles Macourt, John Alefounder, Alexander Pope, Thomas Redmund, Samuel Finney, Francis Cotes, R.A., Charles Sherriff, Miss F. Reynolds, John Foldsone, Michael Moser, R.A., Luke Sullivan, John Jackson, R.A., Christopher Richter, Christian F. Zincke, Mary Benwell, Bernard Artaud, Jarvis Spencer, William Roth, John Plott, Edward Dayes, A.R.A., John Donaldson, Henry Spicer, and Ozias Humphrey. Miniaturists of the nineteenth century—James Nixon, A.R.A., Mary Moser (Mrs. Lloyd), Samuel Collins, Samuel Shelley, Richard Cosway, R.A., Maria Cosway, Charles Muss, Henry Bone, R.A., Andrew Robertson, Alfred E. Chalon, R.A., Sir William Ross, R.A., F. Chinnery, and artists now living. It is hoped that possessors of miniatures worthy of note, either on account of the person represented or of the artist by whom the portraits were executed, will by their contributions give as much completeness as possible to the proposed exhibition, which both from an historical and an artistic point of view will be one of very great interest.

Manufactures.

Paper Material in France.—According to the returns published by the Director of Customs, the following is the weight and value of the rags exported from France during the last five years:—1860, 336,623 kilogrammes, value 354,649f.; 1861, 2,270,971 kilogrammes, value 1,249,934f.; 1862, 4,161,265 kilogrammes, value 2,288,696f.; 1863, 7,171,140 kilogrammes, value 9,040,579f.; 1864, 8,010,715 kilogrammes, value 10,809,606f. It might be presumed from these figures that France exported during the last two years a quantity of rags equivalent to 7 or 8 per cent. of the amount required by paper manufacturers at home, but such is not the fact. The Customs' returns comprise the drills, or woollen rags, which are not used in the manufacture of paper. When these are subtracted it will be found that the rags suited to paper manufactures exported in the year 1863 amounted to 2,877,801 kilogrammes, and the value to 453,901f.; and in 1864 to 2,820,868 kilogrammes, value 429,912f. The removal of the prohibition has not, consequently, deprived French papermakers of more than 3 per cent. of the rags they use. The French paper manufacturers have now resolved to petition the Senate to recommend the abolition of all duty on the export of rags, provided all other nations in Europe would do the same. The papermakers are likewise agitating in a more practical manner. They have established depôts in the less affluent quarters of Paris, such as the 18th and 19th arrondissements, where rags are sorted and washed. Persons employed to collect rags for these depôts will prevent the destruction of an article hitherto so much despised.

French Iron Manufacture.—In 1854 the quantity of pig iron made in France was 750,069 tons, of which 280,000 tons was charcoal-made. In 1863 the rate had increased to 1,180,000 tons, but the proportion of charcoal made was smaller, being only 280,000 tons.

Vegetable Flannel.—This fabric has for some time been in considerable demand on the Continent, and is used in place of ordinary flannel in the case of persons troubled with rheumatism and neuralgic pains, and of those especially whose skin will not bear the irritating action of woollen fibre. Vegetable flannel is a German manufacture, from the *Pinus Silvestris*. Its introduction is credited to M. Léopold Lairitz; and a large number of persons in the Black forests are now engaged in the various processes of separating the oil and the fibre, called *waldwold*, or forest wool, from the pine leaves, and of spinning, weaving, and knitting the yarn. As regards the hygienic qualities of the vegetable flannel, Dr. Hoppe, of the University of Bâle, and other scientific men, rate them very highly. Baths of pine leaves have long been used in Germany and Switzerland in cases of rheumatic affection, and the vegetable flannel is believed, like the baths, to have an immense power in establishing the functions of the skin when they have been interfered with by accidental causes. This result is attributed to the presence of formic acid—which creates a gentle and constant excitement of the skin—and of the tannin and resinous principles which are absorbed by cutaneous action, and supply the necessary elements for restoring a healthy condition.

Commerce.

Ostrich Breeding.—The problem of the domestication of the ostrich in the temperate regions of Northern and Southern Africa, appears already to be attended with satisfactory results; and instead of chasing the bird from its destination, in order to obtain the valuable spoils of its plumage, it can be bred and led to yield its feathers periodically for the wants of fashion. Some few years ago, it was stated that great success had attended experiments at the Jardin d'Acclimatation, at Hamma, in Algeria, the director of that establishment having received the premium of £80 offered by M. Chagot, sen., feather florist, of Paris, a member of the Commission of Valuers to the French Ministry of Commerce, who was the first to get the ostrich to breed in a domestic state; and the reproduction promises to obtain for commerce the ostrich plumes, which are daily becoming more rare and dear. At a recent meeting of the Cape Agricultural Society, M. L von Maltitz, well known as one of the most enterprising and successful farmers in the Colesberg district, gave a statement of his short experience in ostrich farming; and any theory formed as to the profits which might be realised by such a pursuit falls immeasurably short of the result obtained. M. von Maltitz said: "My desire is that a prize be given to the proprietor of the largest number of ostriches in the district. I believe I am at present the only owner of those birds, and, therefore, I may, in making the proposal, be suspected of interested motives. To set that at rest, if a prize be offered and awarded to me, I will return it to the Society, to be again competed for at the following show. My sole object in moving the resolution is to encourage ostrich farming in the district, by which I am convinced, by my own short experience, enormous profits may be realised. Towards

the close of last year, I purchased seventeen young ostriches of three or four months old. I placed them in an enclosure of 300 acres in extent, in which they had a free run. They have been kept there ever since, and have subsisted entirely upon the herbage of the enclosure, except an occasional feed of grain when driven up to the house for the inspection of visitors. I had at the same time other stock within the enclosure, and the opinion I have formed with reference to the extent of ground requisite for their grazing is that 35 birds can be carried year in and year out upon 300 acres of good grazing land —I mean land rather superior to the common run. At the end of last April I had the wings of the birds plucked, where the feathers of commerce grow. In consequence of the youth of the birds, these feathers then obtained were valueless. I now find, by recent examination, that the birds will be fit to pluck again at the end of the present month, verifying the statement made at the last Swellendam show by one of its members, who was, like myself, experimenting in this novel description of farming, that he obtained feathers fully grown from his ostriches every six months. My ostriches are so tame that they allow themselves to be handled and their plumage minutely examined. Being desirous of ascertaining the opinion of those versed in the trade, as to the commercial value of the feathers, I have had the birds examined by several, and the general opinion is that the largest feathers, of which there are twenty-four on the wing of each male bird, are worth £25 per lb., and that the yield of the whole plucking, the majority of the birds being males, will not fall short of £10 each upon the average. I think the statement made at the Swellendam Agricultural Show sets the value of each half-yearly plucking at £12 10s. per bird, and this, I have no doubt, will be the average of mine when they arrive at maturity, according to the present market value of feathers. The original cost of the young birds was about £5 each." In the last Cape papers it is stated that only a few small parcels of ostrich feathers had come to hand during the month, and for those offered at public auction competition had been very keen. All descriptions realised extreme prices, the best being sold as high as £27 10s. to £30 10s. per lb. In 1862 there was imported into the United Kingdom, chiefly from South Africa, Morocco, and France, 33,142 lbs. of ostrich feathers, valued at £76,256.

Mexican Minerals.—Mexico is proverbially a mine of wealth, and one that has, in proportion to its richness, been but little worked. The new regime has given a great impulse to the search for available minerals, and a new find is announced almost every week; M. Rodriquez Sosa has opened up a petroleum well at Hacienda de Santa-Anna, in the province of Ernango; M. Ventura Alcerreca has found a white marble quarry in a small hill called Pescuay, in the province of Zumpango de la Laguna; and M. Hoefonse Lopez a deposit of bitumen in the department of Oajaca, near Port Angel, another to the north of Pochutla, a third on the bank of a stream called Cruz, and a fourth between Port Angel and the sea. Further, a new deposit of coal has been found near the village of San-Pedro, in the gorge of San-Andres, in the province of Ecatepec.

Colonies.

Australian Gold.—The quantity of gold dust imported into the Sydney branch of the Royal Mint, for the purpose of coinage, from the 1st of January to the 14th of October last, amounted to 599,223 ozs., and the coin issued was 2,225,000 sovereigns. For the same period of the year 1863 the receipts of gold dust amounted to 371,366 ozs., and the coin issued was 881,000 sovereigns and 556,500 half-sovereigns. Total value, £1,169,250. The increase in the business of the Mint is solely caused by the large quantities of gold received from Melbourne for coinage, and is not to be attributed to any improvement in the yield of the gold-fields. The following table will show the total amounts received and issued from the 1st of January to the 30th of September, 1863 and 1864, and the weekly receipts from that date to the 14th of October, 1863 and 1864:—

1863.	Sovs.	Half sovs.	Ozs.
January to Sept. 30 ...	845,000	556,500	354,889
October 7 ...	16,000	—	3,437
„ 14 ...	20,000	—	13,040
	881,000	556,500	371,366
1864.			
January to Sept. 30 ...	2,186,000	—	570,645
October 7 ...	—	—	14,114
„ 14 ...	39,000	—	14,464
	2,225,000	—	599,223

Tasmanian Statistics.—The population of the colony, by the census of 1861, was 89,973. The acres in cultivation in the whole colony, in 1863, were 267,173; of these, 139,321 are in the railway district. The value of the crops of 1863, in the whole colony, as given by the Colonial Secretary, was £934,915; the value of the crop, of the district, £427,430. The value of the live stock of the colony, in 1863, as published by the same functionary was £1,478,011, and of the railway district, £493,238. The annual value of the landed property of the colony, taken from the assessment rolls for 1864, was £675,000, representing a capital sum of £11,250,000, whilst the same property in the railway district was assessed at £237,187, representing, therefore, a capital sum of £39,531,000. During the four years ending December, 1863, it appears the excess of the imports over the exports, at Hobart Town, amounted to ££412,907; at Launceston, the excess was, of exports over imports, £416,409—a substantial proof of the commercial requirements of the northern districts, in regard to roads and improved means of locomotion. The yearly average of the customs' revenue collected during the same period was, at Hobart Town, £68,288; and at Launceston, £56,048; whilst the expenditure for civil service, exclusive of public works, has amounted to £105,900 per annum at Hobart Town, against £19,900 per annum at Launceston. The Crown lands sold in the railway district (with Devon) during five years ending December, 1862, amounted to 149,242 acres, for £194,416.

Emigration.—During the past year there have been despatched, by the Emigration Commissioners, 30 ships with Government emigrants to Australia, and four to Natal. Of the Australian ships ten sailed for New South Wales, eight for South Australia, two for Victoria, seven for Queensland, and three for Western Australia. Seven ships were despatched from London, three from Southampton, seventeen from Plymouth, and seven from Liverpool. The passage money ranged from £12 10s. 6d. to £15 9s. 3d. per statute adult, and averaged, for Natal, £12 13s. 10d.; for Queensland, £13 1s. 4d.; for New South Wales, £13 3s. 4d.; for South Australia, £13 4s.; for Victoria, £14 1s. 11d.; for Western Australia, £14 5s.

New South Wales. — Exports and Imports.—The exports from New South Wales for the year 1863 were valued at £6,936,839. The imports were valued at £8,319,576, showing an excess of £1,372,637. Rather more than half the imports came from Great Britain. From the colonies, produce to the value of £2,672,069 was imported, and from foreign countries to the value of £1,106,022. More than six-sevenths of the trade, therefore, in this respect was carried on within the limits of the British Empire. Of the exports England received £2,287,357, the colonies £4,459,101, and foreign states £109,381. The reason why exports to the other colonies figure so high, is, that the export to Ceylon, consisting mainly of gold, was valued at £1,906,983, and the exports to Queensland amounted to £1,070,895, which in-

cludes the exports re-exported coastwise. Next to the United Kingdom the highest imports are from Victoria, and these also represent an intercolonial trade. Queensland comes next in the list; then South Australia, from which breadstuffs are received. Of foreign countries, Manila received the largest sum of money for sugar and cigars; next came China for tea, and next the United States for a variety of commodities. There is very little sold to these foreign countries in return. The live stock imported seaward into the colony was valued at £20,176 The live stock exported seaward was valued at £109,821. This latter branch of business was more flourishing than in any previous year, and was due to the demand that sprang up in New Zealand. Preserved meat was imported to the value of £38,503, and exported to the value of £35,649. The imports of 1863 fell below those of the previous year by a little more than a million sterling, but they were above those of any previous year by nearly as much. The exports fell below those of the previous year by about £160,000, but they were above those of any year previous to 1862. The whole course of trade, therefore, of the year, exhibited some signs of slackness. The most decaying branch of trade was with the fisheries, the imports from which amounted only to £9,431, while in the previous year they reached £27,608, and in 1856 were as high as £39,020. The total value of the export of wool was £1,828,000, which was a higher amount than had been reached in any previous year. The export of tallow was valued at £31,221, which was only about a third of that of the previous year. The timber import was valued at £88,832, and the export at £42,190. The value of the coal exported was £220,181, and the quantity was 298,038 tons. Both in value and quantity this was somewhat below the standard of the previous year.

Queensland Cypress Pine.—Among the other timber products of this district may be mentioned the tree called cypress pine. Of a peculiarly fine and handsome grain, it promises to supply the want much felt there of timber suitable for household furniture, sashes, doors, and interior fittings of houses, while its scent is reported as equal to anything in rose or sandal wood. The tree, which has usually a tall, straight stem, averages a foot in diameter, and splits readily for either slabs or shingles. Few persons appear as yet aware of the existence of this tree, the nearest stock at present known being over twenty miles from Clermont, in the direction of Peak Vale. It is hoped, however, that in the event of cypress pine possessing the properties attributed to it, its proximity may soon be turned to profitable account.

Queensland Sugar.—Some very excellent sugar has been grown and manufactured at the Victorian Cotton Company's plantation. It is said to be worth £40 per ton.

Obituary.

Mr. Henry Blundell, of Hull, died January 29th, 1865, aged 75. Born in 1789, and educated at Lincoln, he crossed the Humber, and after an apprenticeship with the late Mr. William Thomas, in Church-street, Hull, he commenced business there in 1810, and founded a branch of the colour trade in that town, which is at present represented in every important capital in Europe, and fast extending over the world. Under his management the "green" paint manufactured at the establishment has attained such celebrity that the name of the maker is almost invariably associated with the colour. In another branch of trade in which he was engaged—that of seed crushing—Mr. Blundell was the means of effecting improvements of a most important and enterprising character, which have conduced in no small degree to the prosperity of Hull. He applied hydraulic pressure to seed crushing, and was mainly instrumental in raising the machinery to its present state of perfection; the strongest testimony to the soundness of the principles by which he was actuated consists in the universal application of hydraulic power in the trade of which he was the most prominent member. As a man of business Mr. Blundell was universally respected; his liberality and promptitude earned for him the esteem of all men, and the respect of the 300 workmen who were permanently dependent upon him for support. Mr. Blundell had worked long and arduously as a public man; and was one of the oldest, if not the oldest, magistrate of the borough. He fulfilled the duties of the mayoralty in 1852, when the British Association visited Hull, and many members present at that scientific congress still retain pleasing reminiscences of his kindness and hospitality. Mr. Blundell's presence in the Town Council was instrumental in producing several important reforms. An ardent sanitary reformer, he devoted every effort to the amelioration of the social position of the working classes. To his energetic advocacy of the scheme, the public is indebted for the establishment of the baths and washhouses. Of the Infirmary and other local charities he was a liberal supporter. As chairman of the South Bridge Company, he has taken an active part in promoting a project which is likely to prove one of the most important local improvements of recent years. In the rifle corps, too, Mr. Blundell evinced great interest, and presented a valuable prize for competition during last season. He was elected a member of the Society of Arts in 1853.

Eugene Deveria, with his brother Achille (who died in 1857), once occupied a very prominent position in the artistic world of Paris. He had, however, lived for many years at Pau, but was struck down suddenly on revisiting the city of his birth, at the age of sixty years. His best known works are:—"The Birth of Henri IV.," in the gallery of the Luxembourg, which fixed his reputation; "The Reading of the Sentence on Mary Queen of Scots;" "The Death of Jeanne D'Arc;" "The Battle of La Marsaille," in the Versailles gallery; "The Inauguration of the Statue of Henri IV. at Pau, in 1846;" "The Death of Jane Seymour;" "The Four Henris;" and "Reception of Columbus by Ferdinand and Isabella," painted in 1861. He also painted a great number of portraits, amongst which are those of the Marshals Brissac and Crèvecœur, at Versailles. He also executed a ceiling in the Louvre, the subject being Louis XIV. and Puget; and the Chapel of St. Geneviève, in the Church of Notre Dame de Lorette. The brothers Devéria were at one time the leaders of the romantic school. The balls given in their ateliers were the most famous in Paris, and scenes which took place there have been delineated by more than one pencil. All the literary and artistic youth of the period appeared there in coats of mail, satin *justaucorps*, and every imaginable form of knightly, troubadour, and fancy costume. A celebrated art-critic of the present day is spoken of as once resplendent there in the character of Charles IX., and another in the bizarre dress of a poor scholar of Cluny in the olden time. From the atelier of the Devéria are said to have sprung the pointed hat, which, mounted above a luxuriant mass of hair dressed in the style of the Merovingian period, sent young Paris mad about the year 1830. This style of wearing the hair was called *La Perinet Leclerc*, and it was succeeded by another, entirely different, the almost shaved head, then named *coiffure à la mal content*, and later *au forçat*. In or about 1836 these eccentricities almost entirely disappeared, and the once famous leader of the romantic world, Eugène Devéria, retired to Pau, and became a Protestant clergyman, and was famous for the rapid, picturesque, and effective style of his oratory.

Alexander Fraser, A.R.S.A., died on the 15th Feb., at his residence, Wood-green, Hornsey, in the 79th year of his age. He was born in Edinburgh, on the 7th April, 1786. He studied at the Trustees Academy, where he, Sir David Wilkie, Sir William Allan, Sir John Watson Gordon, and David Roberts, were fellow-students under John Graham. With the two last named he had pre-

viously worked in the employ of Bengo, the Edinburgh house painter, before they became fellow-students. He then came to London, and commenced his profession as an artist. His pictures in the public exhibitions gained favourable notice. He became Wilkie's assistant, and during twenty years worked in his studio, mostly on the still-life details of Wilkie's pictures. During this period he was frequently able to exhibit original works of his own at the Royal Academy and British Institution, at which last exhibition he obtained the premium for the best picture of the year, with his "Naaman cured of the Leprosy." This success was followed by his being made Associate of the Royal Scottish Academy, of which he had been one of the founders, and by other honours tendered by his townsmen. Commissions from some of the best patrons of the day followed, and he soon occupied a distinguished position as a painter of *genre* subjects. His principal works were:—"Robinson Crusoe explaining the Bible to Friday," painted in 1836; and the "Interior of a Highland Cottage," painted for Mr. Vernon, and now at South Kensington. The subjects he chose were chiefly Scottish.

Publications Issued.

EUGENE DELACROIX.—FAC-SIMILE DE DESSINS ET CROQUIS ORIGINAUX. Par Alfred Robaut. Printed at Douai.—A remarkable work, both as regards subject matter and execution. M. Robaut has well rendered the sketches of Delacroix, and his lithographic copies are as near fac-similes as possible. Not only are the strokes and touches given precisely as in the original, with here and there the notes of the artist attached, but the various colours and tints of black, white, and red chalk, sepia, pen-and-ink, and pencil, are reproduced with strict fidelity. The work is also well printed. The sketches are on folio paper, and the two series which have appeared at present include more than fifty sketches, or rather sheets, for in some cases there are more than one sketch on a sheet. Each sheet may also be purchased separately, at from two to four francs. The genius of Delacroix is so remarkable in his original sketches that these bear a higher value in proportion to his finished works than is usually the case. His daring male figures frequently call to mind some of those of Michael Angelo. Moreover, many of the sketches are the originals of ceiling decorations, which cannot be photographed, and are, in fact, much superior, in a purely artistic view, than the finished works.

Notes.

PORTUGUESE INTERNATIONAL EXHIBITION.—This Exhibition of Arts, Manufactures, and Agriculture, inaugurated by the Oporto Crystal Palace Company, is under the patronage of his Majesty Don Luiz I. and the presidency of Don Fernando of Saxe Cobourg Gotha. It opens on the 21st August, and is to close on the 30th December. From the 5th to the 15th there will also be, in connection with it, an Agricultural Show of Plants and Animals. Medals and certificates of merit are to be awarded. Mr. Alfredo Allen is the Secretary at Oporto, and Messrs. W. H. Ivens and Son, Colonial Agents, Crutched-Friars, are the agents for the Oporto Crystal Palace Company in London, and will take charge of and forward goods, and represent parties there.

EXHIBITION AT NICE.—A universal exposition of Horticulture, Industrial Culture, Acclimatation, and Scientific Collections, is to be held at Nice, about the 1st of May. Artistic and industrial productions will also be received. Articles may be sold at the close of the Exhibition. The Emperor gives two medals of honour—one to the foreigner or Frenchman who most contributes to the splendour of the Exhibition, and another to the inhabitant of the department (Alpes Maritimes) who does the same. The Empress of the French, the ladies of Nice, the Grand Duchess Helen of Russia, the Prince of Morocco, and Prince Oscar of Sweden, also offer prizes.

DOG SHOW IN PARIS.—A dog show is to be held in the avenue of the Cours la Reine, in the Champs Elysées, near the Palais de l'Industrie, from the 9th to the 14th of May next, under the direction of the Zoological Society. Persons wishing to send dogs are required to make known their intention by a post paid letter to the Director of the Zoological Society in the Bois de Boulogne, previous to the 17th April. The letter is to contain the number, the breed, and the age of the animals proposed to be exhibited.

COD FISHERIES.—From the official returns relative to the French ships engaged in the cod fishery in the North Sea during the year 1864, it appears that the number of cod fish taken in 1864 was less than that in 1863—the weight in 1863 being 2,240,000 kilogrammes, and in 1864 only 2,048,000 kilogrammes. On the other hand, the take of flat fish was double in 1864 to that of 1863. There was likewise a very remarkable increase in the quantity of seal oil brought home. It amounted to only 16,000 kilogrammes in 1863, and increased to 112,000 in kilogrammes in 1864.

LOCUSTS IN SENEGAL.—The plague of these creatures has been fearful this season in the above-named country. Their ravages have been terrible, trees being stripped of the whole of their leaves, and shrubs and small plants being utterly destroyed. The total loss in the case of the cotton plant, which has escaped lightly, is estimated at three-fifths of the crop. In the experimental nursery grounds of the Taouey the cotton plants have been completely destroyed; not a leaf is left. To give some idea of the countless numbers of these insects, it is said that on the 19th of November last the steam dispatch-boat *Archimède* was moored opposite the nursery ground above mentioned, with the Governor on board, when a most extraordinary spectacle presented itself. A cloud of locusts, following the course of the left bank of the Senegal river from west and east, completely hid the land from view, like a thick curtain. The insects flew at the rate of about four miles an hour, and were passing from dawn till sunset, thus forming, as it were, a column from thirty to forty miles long; but, as at sunset the cloud towards the west was much more dense than at any other period, the inference was that what had gone by was merely the avant-garde. The unfortunate cultivators are in a state of despair, while the Moors, who do not trouble themselves with agriculture, console themselves by capturing immense quantities of the locusts, which they declare to be, if not the most agreeable, at any rate the most wholesome food that can possibly be imagined. It is the converse of the old proverb, "What is one man's meat is another man's poison," or, at any rate, destruction. The locusts eat up the poor farmer's crops, and the Moor eats up the locusts, or, at any rate, a few millions of them.

SUPPLY OF WATER TO PARIS.—Few cities were worse supplied with water than Paris not many years since, and still the mode of supplying is primitive, dear, and inconvenient. There is no such thing in Paris, in the ordinary way, as a huge cistern or butt from which the pail may be replenished *ab libitum*. Great reforms are, however, being made in this matter; a water company is gradually carrying its pipes into private houses, and the common ewer is growing rapidly in size. The means taken for increasing the supply are grand, both in conception and extent; aqueducts, canals, and artesian wells are being excavated and constructed in all quarters of the outskirts. One reservoir at Menilmontant, which is rapidly approaching completion, has two stages, and is destined to contain 100,000 cubic mètres of water, at the height of 108 mètres above the level of the sea, and 35,000 cubic mètres in the other compartment at 100 mètres altitude.

At Belleville is another reservoir, also half finished; this is also divided into two parts, one to hold 15,000 cubic mètres, at the height of more than 134 mètres, and the other 25,000 cubic mètres, at an altitude of 131 mètres. At present one of the upper compartments is filled with Seine water raised by machinery at Charonne. The aqueduct for bringing the waters of the Dhuis to Paris is being carried on with great vigour; in the year 1863 sixteen kilomètres of canal and syphons were executed; last year ninety-six kilomètres; and only sixteen or eighteen kilomètres more remain to be accomplished, which it is expected will be done by the month of May. No work of the kind was perhaps ever performed more rapidly. Immense works are going on at Saint Maur for supplying a portion of the reservoirs and the lakes of the Bois de Vincennes; the subterranean conduits are terminated, the foundations for the machinery laid, and the buildings in hand. The lakes are expected to be supplied by these means with water from the Marne in May, and the supply of Paris with the same a month or two later. Two new artesian wells are being sunk; one of these has unfortunately fallen on a stratum of fine sand fifty-six feet thick, which has created great additional trouble, while the other has met with no serious difficulties, and is already finished down to the chalk deposits. In connection with these important works it will be interesting to give the price at which filtered water is sold by the municipal authorities to the water carriers, or other people who choose to be their own aquarii. According to a decree of the Prefect of the Seine, the price is 10 centimes for a hectolitre and a half, rather less than a penny for upwards of thirty-three gallons, and for a pailful one centime, or the tenth part of a penny. This decree came in force on the first of February.

Correspondence.

Cantor Lectures.—Water-supply from Wells.—Sir,—I am much obliged to Mr. Homersham for his notes of the quantity of water supplied from wells in chalk and new red sandstones. Few engineers are better qualified to give such information. In my lecture, and in the abstract published in the *Journal*, I rather pointed out the quantity that might be anticipated from such rocks under ordinary conditions than the exceptionally large quanties yielded by particular wells. I believe I mentioned that such exceptions occurred. Allow me to take this opportunity of correcting an error in the abstract in the second paragraph of Lecture II., referring to the water-contents of sand. In the second column of page 218, line four, the word "ten" should have been *one;* and in line eight, for "ten," read *seventeen.*—I am, &c., D. T. Ansted.

Athenæum Club, March 6.

Volunteer Fire Brigades.—Sir,—Mr. W. Roberts, in his letter which appeared in the *Journal of the Society of Arts* for the 3rd instant, "regrets to see his friend Mr. Young" getting into the track of underrating "the services of the regular brigade." Now, I beg to assure Mr. Roberts that I am not doing anything of the kind; that I fully appreciate the services of the regulars, give them every commendation for their exertions, and every credit for all they do; but I still maintain that they are perfectly insufficient for the work which is now required; that we have no right to ask or expect them to do it; and that we are doing wrong to leave the work to be done by those who have no obligation to perform it. As to his remarks respecting trained men, Deal boatmen, soldiers, life-boats, &c., there is no necessity for a reply to them, for we know what has been done by less likely volunteers than these; but I still say, and it is constantly proved by facts, that far greater results have been, are, and will be, achieved by volunteers than by any *paid* men whatever; and if he says *paid* services are best, surely he cannot feel that he is acting in accordance with his convictions by commending and encouraging the services of a volunteer and *unpaid* brigade.—I am, &c., Chas. F. T. Young, C.E.

7, Duke-street, Adelphi, W.C., March 7th, 1856.

Taking Fish by Submarine Illumination.—Sir,—On Wednesday, the 1st inst., I attended, by invitation, at the Society of Arts, to hear a paper on the above subject. The attendance was good, and the paper interesting. I was, however, much surprised at remarks that fell from the Chairman (Sir E. Belcher); and this feeling, I think, was general, from what I heard around me. The chairman opened his address by proclaiming the prejudices that he had against our fishermen making good seamen, from their liability to be sea-sick, &c. He then proceeded to relate his own surprising success as a fisherman, but could not be prevailed upon to explain the secret of it. The admiral's ideas were evidently those of the old school. I must, however, demur to his law, when he remarked that Mr. Fanshawe's patent "was of no value, as three miles out at sea it could be used with impunity." As well might the admiral say the same of Trotman's anchors, or any other patented marine invention. Probably the admiral also forgot that, unlike his own long cruises, fishing-vessels must, of necessity, frequently return to port; and the owners of those using Mr. Fanshawe's invention without his license would probably find it expensive to rely on the admiral's law with regard to patent right.—I am, &c., J. C. Stovin.

Junior Carlton Club, March 7, 1865.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Society of Arts, 8. Cantor Lectures. Professor Ansted, F.R.S., "On the Applications of Geology to the Arts and Manufactures." (Lecture VI.)
R. Geographical, 8½. 1. Capt. F. Galton, F.R.S., "On Stereoscopic Maps, taken from Models of Mountainous Countries." 2. Mr. James Fox Wilson, "On the Gradual Desiccation of South-Western Africa."
Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. J. W. Bazalgette, "On the Metropolitan System of Drainage, and the Interception of the Sewage from the River Thames."
Zoological, 8½.
Syro-Egyptian, 7½. Mr. B. H. Cowper, "A Philological Examination of certain Names of Places in the Old Testament."
Anthropological, 8.
Royal Inst., 3. Professor Hofmann, "An Introduction to Chemistry."
Wed. ...Society of Arts, 8. Mr. N. P. Burgh, "On Marine Engines from 1851 to the Present Time."
Statistical, 4. Annual Meeting.
Meteorological, 7.
Thurs...Royal Inst., 3. Professor Hofmann, "An Introduction to Chemistry."
Antiquaries, 8.
Royal, 8½.
Linnæan, 8. Rev. W. A. Leighton, "On Sir John Richardson's Arctic Lichens."
Chemical, 8. 1. Prof. Bloxam, "Action of Chlorine on Arsenious Acid." 2. Mr. J. A. Wanklyn, "Vapour Densities."
Numismatic, 7.
R. Society Club, 6.
Fri........Philological, 8.
Royal Inst., 8. Mr. Balfour Stewart, "On the Latest Discoveries concerning the Sun's Surface."
Sat........Royal Inst., 3. Prof. Marshall, "On the Nervous System."

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 21th February*, 1865.

51. Navy (Ships)—Return.
58. Navy Estimates.
Education—Revised Code of Regulations.
Education—Minute relative to Small Rural Schools and Evening Schools.

Delivered on 22nd February, 1865.

31. Bill—Union Chargeability.
3 (40 to 69). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 40 to 69.
42. East India (Revenues)—Return.
Life Annuities—Tables.

Session 1864.

507 (A. viii.) Poor Rates and Pauperism—Return (A).
524. Local Taxations Returns—Return.

Delivered on 23rd February, 1865.

30. Bills—Capital Punishments within Gaols.
34. ,, Bankruptcy and Insolvency (Ireland) Act Amendment.
32. ,, Borough Franchise Extension.
36. ,, Industrial Exhibitions.
3 (70). Railway and Canal, &c. Bills—Board of Trade Reports.
27. Navy (Flogging and Marking) Returns.
48. Queen Anne's Bounty—Account.
65. Committee of Selection—First Report.
28. Court of Bankruptcy—General Return.

Delivered on 24th February, 1865.

33. Bills—Libel.
34. ,, Church Rates Commutation.
3 (71 to 78). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 71 to 78.
37. Mint—Account.
41. East India (Loan)—Return.
46. Augmentation of Benefices—Summary of Return.
49. Metropolitan Improvements—Statement.
50. Army Prize Money—Account.
52. Trade and Navigation—Accounts.
54. Supply—Account.
66. Railway and Canal Bills—First Report of General Committee.

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37. Bills—Railway Construction Facilities Act (1864) Amendment.
39. ,, Common Law Courts (Fees).
3 (79 to 120). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 79 to 120.
6. Isle of Man Disafforestation—Report.
7. Stock Certificate to Bearer—Paper.
14. Tea, Coffee, &c.—Return.
30. Assaults (Metropolis)—Return.
44. West India Islands, &c. Relief—Account.
59. Malta Docks—Papers.
65 (1). Committee of Selection—Second Report.
66 (1). Railway and Canal Bills—Second Report of General Committee.
73. Private Bills—Rules.
70. Ashantee War—Return.
74. Court of Justice Concentration—Return of the number of Houses to be purchased.

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529. Colonial Bills (North America)—Titles, &c.

Delivered on 28th February, 1865.

25. Bills—Court of Chancery (Ireland) (No. 2).
38. ,, Court of Chancery (Ireland) (No. 3).
41. ,, Writs Registration (Scotland).
42. ,, Game (Ireland).

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Books, trimming the edges of—324—W. H. and F. C. W. Latham.
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Boots and shoes, manufacture of—442—R. A. Brooman.
Bricks, clay for the manufacture of—452—R. Hill and R. Tushingham.
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Vehicle for teaching children to walk—537—J. Askew.

Patents Sealed.

2178. T. H. Baker and T. Woodroffe.	2219. C. Moriarty.
2179. J. Smith.	2220. A. Watt.
2190. P. E. Placet.	2236. J. H. Ritchie, jun.
2195. G. Bedson.	2333. P. Barr.
2197. D. Fruwirth.	2347. A. H. P. S. Wortley and W. W. Vernon.
2199. T. Wilson.	2504. H. Tucker.
2203. H. D. P. Cunningham.	2530. J. Batkin.
2207. P. W. Barlow.	2547. J. Hayes.

From Commissioners of Patents Journal, March 7th.

Patents Sealed.

2204. H. C. Lobnitz.	2258. J. G. Hey.
2205. T. Restell.	2860. J. Gothard and H. Garland.
2214. T. D. Ridley.	2885. W. Clark.
2225. D. C. Knab.	3029. W. E. Newton.
2226. G. Clark.	3092. C. Hancock & S. W. Silver.
2232. E. Higham and R. Kirk.	3093. C. Hancock & S. W. Silver
2234. J. M. Fisher.	3094. C. Hancock & S. W. Silver.
2248. R. Townsend.	3110. C. Hancock & S. W. Silver.

Patents on which the Stamp Duty of £50 has been Paid.

555. J. Sim.	613. T. and W. Ball, and J. Wilkins.
557. M. Dodds.	562. A. E. Ragon.
692. R. A. Brooman.	625. J. Platt and W. Richardson.
582. W. Conisbee.	596. W. Tongue.
612. J. Fowler, jun., D. Greig, and R. Neddings.	604. J. Barker.

Patents on which the Stamp Duty of £100 has been paid.

450. R. S. Bartlett.	423. W. H. Graveley.
466. B. B. Stoney.	

Registered Designs.

Fastener and Protector for the Pin of Brooches and other similar Dress Fastenings—Feb. 11—4692—J. R. Hayes, Birmingham.
Bit for Horses—Feb. 15—4693—W. and G. Ashford and Winder, Birmingham.
Lid or Cover of Box Irons—Feb. 22—4694—Enoch Siddaway, West Bromwich.
Bottle Jack—Feb. 22—4695—Farrow and Jackson, 18, Great Tower-street, City.
Gas Carbonising Apparatus—Feb. 24—4696—W. Oxley and Co., St. Mary's Churchyard, Parsonage, Manchester.
Gentleman's Turn-down Collar—Feb. 24—4697—R. Sinclair and Co., 80, Wood-street, City.
Improved Spur Stud Socket and Plug—March 1—4698—W. Evans, Hyde-park Barracks, W.
Antifriction Band for Boots and Shoes—March 4—4699—W. Hallam and R. H. Southale, Birmingham.
Safety Bar for Outside Doors—March 6—4700—Walter Sandell Mappin, Birmingham.

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AND OF

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111TH SESSION.] FRIDAY, MARCH 17, 1865. [No. 643. VOL. XIII.

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ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

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MARCH 29.—"On Window Horticulture, and the Cultivation of Plants and Flowers in Cities and Crowded Localities." By JOHN BELL, Esq.

CANTOR LECTURES.

The Third Course for the present Session will consist of six Lectures "On Some of the Most Important Chemical Discoveries made within the last Two Years," to be delivered by Dr. F. F. CRACE CALVERT, F.R.S, F.C.S. (Corresponding Member of the Royal Academy of Turin; of the Société Industrielle de Mulhouse; of the Société Imperiale de Pharmacie de Paris, &c.), on Tuesday evenings, at Eight o'clock, as follows:—

APRIL 4TH.—LECTURE 1.—On the discoveries in Chemistry applied to Arts and Manufactures.

APRIL 18TH.—LECTURE 2.—On the Discoveries in Chemistry applied to Arts and Manufactures (*continued*).

APRIL 25TH.—LECTURE 3.—On the Discoveries in Agricultural Chemistry.

MAY 2ND.—LECTURE 4.—On the Discoveries in Physiological Chemistry.

MAY 9TH.—LECTURE 5.—On the Discoveries in the Chemistry of Rocks and Minerals.

MAY 16TH.—LECTURE 6.—On the Discoveries in the Chemistry of Metals and Alloys.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture.

MUSICAL EDUCATION.

The Committee appointed by the Council to inquire into the present state of Musical Education at home and abroad, consists of the following gentlemen:—

Wm. Hawes, Esq., Chairman of Council.
Lord Henry Gordon Lennox, M.P.
Lord Gerald Fitzgerald.
Sir John P. Boileau, Bart.
Sir George Clerk, Bart.
Sir John Harington, Bart.
Sir Francis Sandford.
Colonel Scott, R.E.
Capt. Donnelly, R E.
Edgar A. Bowring, Esq., C.B.
Harry Chester, Esq.
Henry Cole, Esq., C.B.
Herbert Fisher, Esq.
Samuel Redgrave, Esq.

His Royal Highness the Prince of Wales, President of the Society, has consented to honour the Committee by acting as its chairman.

Proceedings of the Society.

CANTOR LECTURES.

SECOND COURSE.—SIXTH LECTURE.—MONDAY, MAR. 13.

MINERAL VEINS, ORES, AND MINING.

Professor ANSTED commenced by stating that the last division of his subject included mineral veins, their contents, and the methods adopted to extract these contents. Metals are obtained either native or as crystalline minerals, called ores, from certain fissures and veins in altered rocks. The obtaining of ores from veins is metal mining. All rocks now above the water have been raised to their present position by some powerful upheaving force. They must have been dried before being elevated, and this involves contraction. Contraction and elevation must have produced cracks and fractures, whose nature depends partly on the rock itself, and partly on the mode of action of the moving force. It is not possible to conceive upheavals without fissures; but they are of two kinds, as due to two causes. Those caused by contraction will be governed by chemical laws. Those caused by upheaval will be regulated by the amount of force exerted, the weight to be lifted, the direction of the upheaving force, and the mechanical condition of the rock at the time of up-

heaval. The first kind may have begun as soon as the rock existed. The second kind commenced with the first upheaval. They may be due to a multitude of movements going on for a long time. During long periods such fissures may have remained unaltered. From time to time they may have been interfered with by other fissures. But cracks once formed, and then neglected, may have been filled up with fragments of the adjacent rock, or with crystals that have grown in the cavity. A crack in a mass of limestone may be occupied with calc spar. A wide fissure in such rock may be filled with rolled blocks of limestone. An empty space may have become filled with lumps of zinc or lead ore. All rocks present phenomena that have some resemblance to those of mineral veins; the formation is an ordinary event in nature. Crevices formed during the elaboration of a rock, are small, and filled up with crystalline material derived from the rock itself. The rock is purged of foreign contents by aid of these cracks, and by the facilities they offer for throwing off substances of which there is only a small proportion. But the filling up of crevices formed by contraction need not differ from the filling of wider cracks. The crevice must be formed before the filling up can begin, and thus every true crack must have defined walls. This distinguishes true veins from differences of condition and of mineral composition which belong to some process of segregation. The successive veins in slates and granites, elvans, bands in clays, and coloured lines and marks in sandstones, are of this nature. They are modifications of the rock, but not mineral veins. Of the two classes of fissures those produced during the formation of the rock are the simpler and the most common. All fissures in rocks, filled with crystalline minerals may be called mineral veins, but only those which contain valuable ores are lodes or metalliferous veins. The origin of the vein is of small importance, but its history is interesting, and will guide the miner in following the traces of the vein when it is lost sight of. Metalliferous veins in stratified rocks are chiefly confined to accumulations of lead and zinc ore and carbonate of iron in natural open spaces or caverns in limestone. It is difficult to explain this, but it is a law of nature, at least with certain limitations. Let us see what these veins are like, and what clue we can obtain to their history. Between and amongst limestones, where the bedding is regular, and cavities occur at the interval between two beds, there may be deposits of galena and calamine. These cavities communicate with others by crevices across and between the strata. How far the natural cracks may have been enlarged by subsequent upheaval, it is impossible to say, but the main deposits of ore often seem dependent on the stratification. There is little guide to the discovery of veins of this kind when lost, beyond a careful following of the clue afforded by a thread of ore. Useful mineral veins are the result of disturbances that are systematic, and they often correspond with the structure of the part of the country where they occur. Thus, in Cornwall and Devon there is a chain of granite bosses ranging east and west, and a quantity of slates, schists, &c., having a similar range. In the slates, schists, and granite are numerous metalliferous veins. Of these some are more regular, and better defined than the rest. Such veins are called master lodes or champion lodes. They are parallel to each other, and may be recognized as belonging to a system. These main lodes range in the same direction as the axis of elevation of the district. The general range of the local geological axis of the country being made out, then the direction of the main lodes are parallel to it, and the lodes of next importance at right angles to it. And this law is an expression of the fact that mineral veins are fissures in altered rocks, produced systematically by mechanical force elevating the whole district, and breaking up the rocks in a manner that may be estimated mathematically. If a rigid solid, tied down on all sides, be exposed to pressure from below, sufficient to overcome the tension of its parts, it must crack on yielding, and these cracks will follow certain laws. They must be parallel and at right angles to each other and to the elevating force. One important conclusion from this mode of considering mineral veins is, that in different countries the systems of veins must exhibit different directions. Thus, while the ore-bearing veins in Cornwall are east and west, in other districts they may be north and south. The direction of elevation must govern the formation of each system of veins. But if veins are due to disturbances that have acted at intervals during a long period of time, and not always in the same direction, the axis of disturbing forces may change, and there may be new systems of veins crossing older systems. Or successive elevations may produce complication in a different way, breaking up and heaving the mineral veins after they have been filled. Thus are produced faults and throws. In the determination of the law that governs the distribution of lodes, we should know the direction of the axes of elevation that have effected them, and the order of the occurrence of the disturbance. The fissures formed in rocks, whether on solidifying or whilst elevation was going on, must approximate rather to a vertical than horizontal direction. Thus mineral veins are often almost vertical, or if inclined they are so slightly and irregularly. But fissures in rocks are not lodes until they have been filled with mineral matters. These are usually crystalline. The filling up distinguishes the mineral vein from the open fault, or crevice, and the lode from the mineral vein. There is no reason why a fissure open at the top, or a crack formed during the construction of an ordinary fault, should not become filled with stones from above or from the walls. Occasionally the vein contains substances washed in by water from a distance. But when mineral veins are filled with spar the case is different. The material may have been carried in from above and deposited from water. In this way some veins in limestone contained in a solid mass angular and rolled lumps of limestone, galena, blende, calamine, and shells. The cementing medium is carbonate of lime, and the agent water. So it is possible that crevices open below have received minerals in the state of vapour. Of these sulphur and arsenic are familiar examples. The former is found lining the walls of cavities. In volcanic districts examples of this are common. Thus deposits from above, brought in with or without water, and deposits from below, with or without steam, are methods adopted by nature. But no one familiar with veins will suppose that all known cases can be thus explained. The vast majority of lodes are lined with crystalline minerals which have commenced to form on each wall of the vein, and not either at the top or lower part. When the deposit has begun, the crystals have accumulated symmetrically. Assuming that crevices have become converted into veins by chemical action within the rock, this either involves the conveyance of foreign material by water circulating through the veins, or the passage of this foreign material through the mass of the rock itself. Both are possible. Water circulates through all free spaces in the interior of the earth. It is often hot, and loaded with a variety of minerals. Hot water no doubt has been largely concerned in bringing various ores as well as earthy minerals into veins. The filling up of veins is a subject of the deepest interest to the miner. He would willingly discover a law by which he could convince himself of the existence of ore from the nature of the surrounding rocks, or from the surface appearance of the lode, or from the intersections of lodes with each other, or with some particular kind of rock; or from the degree of inclination of the lode. Such laws are not known, and it will be long before observations on these conditions justify absolute conclusions. But there is some relation between the contents of a lode and the conditions under which it has become filled. By observing facts, and studying their mutual relations, miners have found that a gossan or iron oxide at the top of a lode is an indication of a course of ore. The condition of the gossan is significant,

some iron stones being recognized as favourable and some unfavourable. A "kindly gossan" is to a Cornish miner an indication of a valuable lode. So the fact that in lodes crossing each other, or in lodes traversing both granite and slate, there is generally a deposit of ore either at the intersection of two lodes, or at the point where a lode passing out of one rock enters another, must be regarded as tolerably well established. Little is known of the cause of this result. It may have been due to an electric or galvanic action, or it may have reference to causes altogether distinct. The study of the observations illustrating this rule cannot fail to be useful; but we are met by the difficulty of assigning a satisfactory reason for a phenomenon certainly very common. The condition of the enclosing rock is not without influence on the contents of a lode. An experienced miner will judge by reference to this of the value of an unworked vein. Certain conditions of softness in slate and granite are considered favourable, but a compact rock rarely contains large quantities of valuable ore. This applies to quantity rather than quality. Less important is the inclination of a lode. The valuable lodes of a mining district have certain mutual relations, but there is no clear identification of the cause. Certain metals and ores are common in lodes having one general direction, while other ores belong to other rocks and to cross-courses. This is the case in all mining districts. In Cornwall the copper and tin lodes are usually in the direction of the axis of elevation, and are far the richest in ore; the lead veins are in the cross-courses, and are less important. In other districts, where the lead ores are in the main line of upheaval, the copper ores are of small amount, and occur in the transverse fissures. Mineral veins contain native metals, oxides, sulphides, or carbonates. Other combinations are less common and less abundant. All these are found in veins mixed with quartz, with crystalline salts of lime, and with clay, in large quantities. It is in mineral veins that the larger proportion of those combinations occur that seem to have little importance on the earth's crust, but that must certainly have uses and influence. Few metals and ores are sought with much care. The chief are, iron oxides and carbonates, iron pyrites, native copper, oxides, sulphides, and carbonates of copper, oxide of tin, sulphide and carbonate of lead and zinc, sulphide and oxide of silver, native gold and silver, native mercury, and sulphide of mercury. The metals and minerals of which the supply and nature are such that they are unknown in the general market are not here referred to. All ores are not found in abundance in the same district, in the same kind of rock, or in the same kind of vein. Certain laws exist, in obedience to which they may be looked for, and these laws must be ascertained by observation. What is true for Cornwall is true in principle, but not in detail, for Wales, for Chili, for Cuba, and Australia; and if the experience acquired in Cornwall is taken abroad, and there applied without consideration of the change of circumstances in the deposits, it will fail. Mineral veins containing ore are of very various dimensions. Of their length little is known. They are traceable in some cases for many miles at the surface, and below the surface they probably run on for far greater distances. It is difficult to say what is the inferior limit of length, for pipe veins and shoots are often in sets, and connected by narrow crevices. The width is more determinable than the length, and varies from a few inches to many yards. A silver vein in Mexico exceeds fifty yards, though not for any great distance. The width is sometimes increased by parallel fissures filled with ore, and threads of ore pervading the rock that encloses the vein. This condition of veins is a stockwerk, and lateral veins are called also strings. The depth to which mineral veins bear useful deposits of ore is unknown. Tin and gold have been supposed to abound near the tops of lodes more than at great depths but this is not likely. The tops of lodes often consist chiefly of quartz and iron oxide where the lode contains a large quantity of iron, with or without copper or other metals, and where the vein stone is siliceous. Veins in granite and slate are vertical or nearly so, and the same system of lodes generally shows the same underlie. In limestone they are often zigzag, mere gaps of small depth, or open spaces between certain beds of limestone and shale. There are certain associations of earthy minerals with metal. The sulphides of copper are generally accompanied by siliceous minerals. Rich ores of silver are often found in gneiss, with quartz, while silver-lead ores and galena are abundant in limestones. These general indications of habitat are useful, but they cannot be trusted in all cases. Owing to the nature of mineral veins and lodes, their hardness always differs from that of the enclosing rock. If harder, they stand out above the surface as walls; if softer, the top of the lode is more rapidly weathered than the walls, leaving a depression. In either case the lode is broken away, and carried along the surface by water. When left behind the heavier portions containing the ore will be accumulated in certain places, but in smaller quantities and smaller particles, as they are more distant from the lode. By following up from point to point the traces of a lode from these fragments, a miner will discover the position of the lode. This is called shoding. When a lode is reached it is necessary to prove its direction and underlie, its width, and its condition at various points of outcrop. For this purpose trenches are cut across the direction of the lode at certain points where it ought to be. These are called costeaning pits. These are generally the best means of discovery, without the outlay of much money and labour, and the lapse of a long period of time. Mining is speculative; and of all kinds of mining that which is most elementary, namely, the discovery of valuable lodes is the most speculative. At one time a trial and the expenditure of a few hundred pounds will lay bare a deposit of enormous value; at another, the utmost prudence and intelligence, with capital, will end in failure. Lead and zinc deposits in limestone are different from veins in granite and slate, and the search for lead is thus different from that adopted in reference to copper. Lead deposits are irregular, and the process of shoding adopted on the surface with regard to copper, is applicable underground for lead. In some lead districts, were the ore is found between bands of limestone, this method is applicable; Derbyshire is an example in point. It is not so in Flintshire and the Isle of Man, which are also lead-mining districts. Mining districts are to some extent indicated in a good geological map. They occur where rocks have been metamorphosed; where granites and slates and schistose rocks are found; where granite appears; where the contact of granite with sandy and clayey material is marked by changes in sands and clays, and where limestone is disturbed, we may look for fissures systematically grouped, and containing crystalline minerals and ores. The more remarkable of such districts are those in England, Cornwall and Devon. Derbyshire, Northumberland, and Cumberland are the chief mining counties for metalliferous ores in mineral veins. North Wales supplies lead and copper, and the Isle of Man is rich in silver-lead ore. In North Wales gold has been found. Ireland contains copper mines. Scotland contains lodes in its south-western counties. France presents five metalliferous districts. Belgium is rich in zinc and lead. Spain is exceedingly rich in most of the metals. Italy is very rich in iron and copper. Germany was the cradle and is the school of scientific mining, and the variety of minerals found there is very great. Silver, copper, lead, tin, cobalt, nickel, bismuth, antimony, and iron are all found there, and some under circumstances of extreme interest. Scandinavia abounds in iron and copper. In Russia there are many mining districts, and silver and lead are worked in the Altai mountains. Throughout Asia mining districts are known to exist; and the islands of the Southern Archipelago, as well as Australia, contain important supplies of useful metals. Both North and South America

are metalliferous, and Central America still yields the chief supplies of silver. The native copper on the shores of Lake Superior is one of the most remarkable deposits in the world. When a lode is known to exist, and the indications justify operations, it is usual to sink a pit on it or cut it by a level or adit driven in from the nearest hill-side. If ore is found it may be run out from such an adit, and if water comes in it may be drained without cost from all workings above the point at which the adit cuts the lode. Assuming that the lode improves on going down, and justifies a farther outlay, a shaft is put down to cut it at some convenient point. At various depths cross-cuts may be made towards the lode to prove its position and the state of the ground and of the ore. All lodes are in their nature irregular. They contain what are called courses of ore, or they are bunchy and contain pockets of ore. The former condition is that of a deposit of ore uniform within certain limits of depth and distance, succeeded by barren portions. Experience has too often proved that there is no dependence to be placed on the presumed continuance of courses of ore in any direction. Bunches and pockets of ore consist of expansions of a lode filled with ore, or portions of a large lode exceptionally rich. Courses of ore occur not unfrequently in the great copper mines of Cornwall. Pockets of ore are most common in the lead-mining districts. Mining work includes—first, the removal of ore already discovered; secondly, the laying out, and bringing into a convenient state for extraction, the courses and bunches of ore already discovered; and, thirdly, the organising of trials and discoveries in those parts of the lode not yet proved to bear ore. Judgment is needed in laying out a mine so as to secure a supply of ore to pay expenses, retaining a reserve in the event of the supply failing, and expending a fair proportion of the profits in trial work. Owing to the irregularity of lodes, shafts must be put down to suit the condition of the lode. Thus slant shafts are sunk either from the surface or from some point below, and, by perpetually following the ore and removing it wherever there is sufficient to make it profitable, the works become extremely complicated. It is impossible to carry on mining operations on a large scale in mineral veins without timbering. When the vein is nearly vertical, it requires little timbering to prevent the walls from coming together, especially when the country is solid, and the walls clearly defined. But there are cases where the excavations are so large as to render timbering a very costly operation. Sometimes the waters of the mine tend to rot the timbers that are used to shore up walls, and keep the overhanging wall from closing in on the foot-wall. There is no objection to the use of gunpowder in blasting in metal mines. Judgment is needed in deciding on the position and depth of the bore-holes, to take advantage of natural joints in the rock, and remove large blocks. The plan of a metal mine is rarely systematic. But there is always one leading idea based on the method of removal of the water, and connecting this with discovery. Where the rainfall is large, the water that accumulates in a deep mine may become very considerable, as it comes in from above, from the sides where the lode connects with small branches and strings, and from below. It must be removed at the smallest possible cost; but, unless care is taken, the water lifted from one mine may find its way down another, or require to be lifted over and over again from the same workings. To avoid this, systematic drainage of groups of mines is desirable, and deep adits are cut, which receive the waters of a number of properties and convey them to a distance. In Cornwall the great adit receives the waters of the numerous mines in Gwennap and Redruth districts, and measures thirty miles in length. One branch penetrates ground seventy fathoms below the surface. The water thus conveyed is discharged into the sea forty feet above high-water mark. In the construction of long lines of deep adit, it is desirable to cross at right angles the direction of the principal lodes of the district. Metal mines are reached by ladders placed vertically in the shafts, but when the depth is great the descent and ascent become extremely exhausting, and waste time as well as strength. Of late years, man-engines have been adopted, by means of which the men can reach their work and leave it with comparative comfort. Man-engines are not needed for shallow mines, and would not be advantageous where the depth is less than 200 fathoms; below this the gain is very great. Almost all the mining work in Cornwall is executed by contract. There are two classes—the "tutmen," who excavate at a price per fathom of ground, and the "tributers," who speculate on ore ground when reached. Poor mines are worked by tut-work, but when good ore is reached the tutman engages to raise it at a certain price per fathom. In other cases the tributers come in and speculate. They agree to work a portion of the lode for a given time, receiving a certain agreed portion of the ores raised. If the ore be rich, they accept a small percentage of the value, if poor, they demand a larger percentage. The captains, having decided the value to the best of their judgment, put up a portion or *pitch* to auction, the bidding being downwards, and the parties who bid being each represented by one man. The ores are generally raised by machinery and broken at the surface. In addition to the quantity of rubbish left below there is thus generally a waste heap, or *attle*, at the pit-mouth. This is produced during the operation of *dressing*. Professor Ansted then gave a brief recapitulation of the general subject, and concluded with the following remarks:—Thus it is that geology, applied to the arts, is a subject of real and vital interest to all of us. In endeavouring to illustrate this, and interest you in the subject, I have confined myself as much as possible to familiar facts and exemplifications. I need not point out to you that to follow these generalisations into detail one must possess a very wide range of knowledge and great practical experience. These can rarely be combined in one person; and thus the agriculturist, the engineer, the miner, and the manufacturer must each learn his own department of practical geology, and apply it to his own purposes. The search after this knowledge is as interesting as the knowledge itself is useful; and the interest is increased when the student, before seeking out that which belongs to his own department, will make himself master of so much of the general subject as to see the bearings of theoretical views on all the details that come before him. There are other applications of geology that I have not brought under your notice in these lectures. Among them I would especially point out its application to the fine arts. I mention it now to remind you that the subject of applied geology is far from being exhausted; that, in fact, I have only considered it in one aspect, and that the many-sided science that deals with the earth, its history, its structure, its grand physical features, and the causes that have produced and are daily modifying them, is no less calculated to interest the artist and the poet than the farmer and the manufacturer. There is no limit to the study when we engage in the comparison of the works of Nature, with their application to the requirements of man, and the operations of man's intellect.

Fifteenth Ordinary Meeting.

Wednesday, March 15th, 1865; Thomas B. Winter, Esq., in the chair.

The following candidates were proposed for election as members of the Society:—

Brandt, F. C. W., 3, Abchurch Chambers, Abchurch-lane, E.C.
Drake, Francis, Friar-lane, Leicester.
Jacobs, Lewis, 146, Strand, W.C.
Kiel, George Middleton, 16, Stanley-gardens, W.
Oakes, William Smith, Addison-road, Kensington, W.
Simes, N. Phillips, 58, Coleman-street, E.C.

Strachan, Mrs., Norfolk-house, Arundel-square, N.
Wilkin, Frederick, 10, Spring-gardens, S.W.

The following candidates were balloted for and duly elected members of the Society:—

Dibley, George, 72, Malden-road, Haverstock-hill, N.W.
Miles, Henry Thompson, 61, Strand, W.C.
Redman, Capt. Gabriel J., 6, Belsize-park, Hampstead, N.W.

The Paper read was—

ON MARINE ENGINES FROM 1851 TO THE PRESENT TIME.

By N. P. BURGH, Esq., Engineer.

The history of the origin of the marine engine, and its slow advance, has been so often written, that I feel assured I shall not cause much disappointment if I pass over that already worn-out subject. I propose, therefore, to introduce to your notice the marine engine as it was in 1851, and the improvements which have taken place from that period to the present time. As the present paper alludes to the year 1851, it will not be deemed out of place to describe briefly the marine engines shown in the Exhibition of that date. The screw propeller was then making but slow progress, consequently the attention of our engineers was diverted from straining their talents to produce more perfect arrangements. The following examples of marine engines were exhibited.

For the paddle-wheel, the engines were arranged as follows:—Vertical, angular or inclined, direct-acting, and oscillating; for the screw-propeller, a more varied and numerous collection was given, comprising disc, rotary; for horizontal direct-acting types, were the following, double piston-rod, return connecting-rod, trunk; after which, annular cylinder, vertical direct-acting, inclined direct-acting, single piston-rod; and, lastly, a beam engine. The largest pair of engines were 700 horse power collectively, horizontal, direct-acting, single piston-rod. The trunk engines were 60 horse-power collectively; these two examples were adapted for the screw. For paddle-wheels, the engines of the greatest power were a pair of 140 horse-power, of Belgian repute, the framing and paddle-centres being of wrought-iron, thus ensuring sufficient strength with a reduction of material and weight. To describe each engine in detail would be tedious, as well as of little value to the engineer of the present day. Allusion to the defects and improvements will be found under the different descriptions of the necessary appendages.

I will now proceed with a brief notice of the marine engines exhibited in the year 1862, when it will be seen that a great improvement had taken place between the two dates alluded to. We are, I am happy to state, still making an advance, and I trust to be able this evening to describe these improvements; but, at the same time, I beg to suggest that there is plenty of room for further improvement in the detail of marine engines, which, doubtless, will be ere long taken into consideration by those interested in these matters.

In the year 1862, our International Exhibition was again held, and with much success as far as regards marine engines. The class exhibited showed great improvement, both in design and arrangement. The oscillating engines adapted for the paddle-wheel did not exhibit much alteration, although it cannot but be said that in detail a change for the better was perceptible. With reference to the engine adapted for the screw, a complete revolution had taken place since the Exhibition of 1851. Valves and gear were altered, starting gear simplified; positions of condensers, air pumps and valves, in a much more correct state; number of details lessened; and, in fact, the entire arrangement fast approaching to a nearer state of perfection, viz., accessibility to all the parts in action without disarrangement. The following is a brief account of the writer's observation of the class of marine engines exhibited:—The paddle-engines were vertical and inclined, oscillating, of the ordinary type and arrangement. The valve gear was of two kinds—the counter-balanced eccentric, and the ordinary link motion. The air pumps were worked by eccentrics in some instances, and in others by cranks. The mode of starting was by the ordinary ratchet or wheel and pinion—the bilge and feed pumps were, in some cases, worked by the oscillation of the cylinder, and in others by separate eccentrics. The means for disconnecting were of the disc and the drag-link kinds. Paddle-wheels were exhibited with fixed and feathering floats. Five examples of oscillating engines were exhibited, including models and drawings. The engines for the screw propeller were as follows:—One pair of double trunk engines, having injection condensers with an improved arrangement of air-pumps and valves. The double piston-rod return connecting-rod type was well represented; this arrangement is used on account of the great length of stroke and connecting-rod attainable in a given space. In the Exhibition now alluded to there were six pairs of engines of this class, with injection condensers and air-pumps of the ordinary arrangement, and one pair of engines with the improved arrangement of condensers, pumps, and valves. The single piston type of engine was not largely represented—one pair with the improved injection condenser, pumps, and valves, and one pair with those of the ordinary kind. The single trunk arrangement was represented by one pair, with single-acting trunk air-pumps in the condensers. The air-pump trunk with double piston-rods return connecting-rod engine was shown by drawings only. Vertical direct-acting engines were represented thus—one pair with annular cylinders, double piston-rods, and injection condensers of the ordinary kind; one pair with single piston-rods and surface condensers; and another pair as the last, with ordinary condensers.

It will be understood that in the previous examples the cylinders were arranged in pairs, the cranks being at right angles. In order to obviate the strains imposed at the extremity of each stroke, one firm exhibited engines with three cylinders, with spur gearing for reversing, stopping, &c., which were termed the expansive and economical principle. Lastly, I allude to the writer's invention "Burgh and Cowan's patent antifriction trunk engine," so arranged, that the friction of the trunks is dispensed with, and no area lost in the cylinder. This arrangement was represented by a pair of engines and drawings. Having thus briefly alluded to the marine engines exhibited in the two International Exhibitions of 1851 and 1862, I will now proceed to give a detailed description of each portion.

The arrangement of marine engines in the hold of the ship is, perhaps, not generally thought to be of so much importance as it really is. It should be strictly understood that the attention required for engines of river steamers bears no comparison with that required for marine engines; imagine a ship in a gale, and heated bearings, and a faint idea can be formed of the duties required, and the reason for a free access to all the working parts.

For the purpose of illustration to those present, not professional engineers, I will briefly specify what the necessary component parts of a pair of marine engines of the present day consist of, viz., cylinders, pistons, slide valves, piston rods, slide casings, expansion valves, blow-through valves, piston rod guides, connecting rods, cross-heads, main frames, crank-shaft, eccentrics, rods, links, valve rods, guides, condensers, air-pumps and valves, injection valves, snifting valves, discharge valves, bilge and feed-pumps, valves for the same, starting gear, and turning gear, lubricators, and all the necessary levers, bolts, nuts, &c. It will thus be seen that marine engineers have more difficulties to contend with than is generally known. To understand the use and real character of each of the above details is not the work

of weeks or months, but years. It should not be forgotten either, that the honour of our nation, and the lives of its representatives, are often in the hands of the marine engineer. I will now proceed with the descriptive illustration of details, showing defects, improvements, and suggestions for the future, commencing with slide valves.

These valves govern the entrée and exhaust of the steam to and from the cylinders. Two kinds or classes of valves are now universally used, the common and the equilibrium; the former is so well known that a description of it is scarcely necessary. I will only observe that its use for larger engines is much on the decrease, on account of the stroke of the valve being due to its outside lap, which for large ports is considerable. Equilibrium valves are so called from the equal action of the steam tending to lift the valve from, as well as to press it on its facing. These valves are double-ported to reduce the stroke. One firm has lately introduced three-ported valves, to still further reduce the stroke. In order to reduce the friction of the valves on the facings, rings are used encircling the body of the valve, adjustment being gained by screws, ratchets, and springs to prevent looseness. In some cases a communication from the back of the valve to the condenser is arranged, to still further reduce the pressure on the valve facing. Slide rods are usually one to each valve, but latterly two have been introduced for large valves, which no doubt greatly assist in guiding the valve during its action.

The next portion in rotation will be that for working, reversing, and stopping the action of the slide valve, universally known as the "valve-link motion." The date of the origin of this motion is doubtful. Mr. Zerah Colburn, in his new work on locomotive engineering, tells us, however, that 1832 is the earliest period of its application for locomotives. Marine engineers introduced it firstly for oscillating paddle-wheel engines; afterwards for fixed, horizontal, and vertical engines adapted for the screw propeller. The object of the link motion is to reverse the action of the slide valve without disconnection. The links now in use are of two kinds—slotted and solid. The slotted link has the sliding block within it, whereas that of the solid kind slides within the block. The means adopted for raising and lowering the link are various. One maker prefers to use a lever, secured on a weigh-shaft, passing over the front part of the cylinders, motion being given by a worm and wheel, the former being keyed on or forming part of the starting wheel shaft. Another firm deems it better to impart motion to the lever by a ratchet and pinions. A third authority raises and lowers the link by a rod connected to a block surrounding a coarsely-pitched screw, motion being given to the screw by mitre gearing; whilst another firm prefers to fix the block, with the screw to be elevated and lowered. These two last are undoubtedly the most powerful of the examples given.

The systems at present adopted for guiding the slide valve rod are of three kinds. First, the dove-tailed guide, similar to that used by tool-makers for the arm of a shaping machine. Secondly, a block of gun metal sliding on two fixed turned rods as guides over and under the valve rod. Thirdly, the valve rod secured to a square bar, working in a bracket, and cap to correspond. This last may be said to be the most simple, but perhaps not so rigid as the first example. The double guides are complicated, but at the same time produce the rigid resistance to the strains imposed on the valve rod by the vibration of the link.

Some makers of marine engines prefer to allow the link to rest or hang on the block pin inserted in the lever of the slide rod weigh-shaft. Such a practice dispenses with guides. Excessive vibration of the link on or in its block greatly deteriorates the action of the valve, it being understood that whilst the link has an ascending or descending motion, as well as sliding, the strain on the valve rod is increased, and at the same time the stroke is effected. The excess of the vibratory motion is painfully perceptible in the ordinary slotted link; the eccentric rods being connected beyond the block pin, a direct-action cannot ensue. The distance between the centres of the eccentric rods and block regulates the amount of indirect action. Links of this kind are often hung from a rod connected in the centre to the link, either to the clip or at the back. This is far better than at the lower end, as the connection of the suspension rod regulates the ascending and descending motion of the link whilst at work. The link resting on the block when for going a-head, obviates to a certain extent some of the evils alluded to. The gain by the introduction of the solid link, with the eccentric rods connected at its extremities, is strength with less material, but the vibrating motion is not decreased. In order to obtain a more direct, and, if possible, a perfect action, the eccentric rods have been secured to the link, so that the centre of connection may be on that of the block, and by this the vibratory motion is effectually got rid of. There have been two distinct modes for accomplishing this, which I have had the opportunity of observing. The first example is—two solid links, one on each side of the block, the eccentric rods being connected to pins on the outer face of each link, the inner face and sides being sustained in a groove in the block, which oscillates on its axis, in the eye of the valve rod, the links being one on each side. The second example is like the first in principle, but one solid link only is used, of a dove-tailed form in section, at the inner face, to prevent the link from slipping out of the groove in the block; the eccentric pins are fixed in the extremities of the link, and the rods are attached as in the last example, but with a single eye. The writer has designed a solid link and connection, which, although not superior in principle of action to the two last examples, is more simple in construction, and has less working portions; therefore it may be held to be worthy of introduction. A solid bar of iron is slotted at each end, to receive the single eye of each eccentric rod, so that the entire surface of the link remains unbroken; it is secured in a block with an adjusting portion and key at the back, the front being open sufficiently to admit of the ascent and descent of the eccentric rods; adjustment in front can be attained by loose portions and set-screws, but this last is not imperative, as the wear of the link and block is very slight when the acting eccentric rod is on the centre of the block; the block has provisions on each side for suspension, the valve rod having portions formed to receive the block; the back part of the rod works in a dove-tailed guide of the ordinary kind.

It now becomes necessary to treat of the suspension or lifting rods for solid links; for this a few words will suffice. As the ascent and descent of the link whilst in motion are governed by the length and position of the rod, it is almost needless to state that the suspension rod should be connected in the centre of the connection of the eccentric rod. The link, when for going a-head, should be down. It may now be argued that the vibration of the link, when for going astern, must be excessive. Granted; but as the forward motion of the ship is of the most importance, it is not unfavourable to economy to adopt the connection alluded to. In some cases the solid link is guided at the top or bottom, but this is only required when an overhanging or outside connection of the eccentric rods is resorted to.

The next portion for consideration is the expansion valve and gear; the use of this valve is to allow the steam to be cut off at the early or given part of the stroke of the piston, and the expansion or elasticity of the steam completes the power required. Now it is certain that the use of high pressure steam for large cylinders and short strokes, produces excessive shocks at the commencement of the strokes, and thereby entails an increase of strength in the materials used, so that the proportions are larger than when for ordinary purposes. It is clear also that, when steam is admitted at an excessive pressure against the piston suddenly, it (the piston)

receives an impetus equivalent to the power imposed, and in no case whatever could an engine of proportions for low pressure resist the strains imposed by the use of high pressure steam. The ordinary pressure adopted by marine engineers is from 20 to 30 lbs. per square inch, more often the former than the latter. I am not aware, however, of any cause why 60 to 80 lbs. should not be adopted, with a great increase of economy and power. Of course the present proportions of engines and boilers would have to be increased, if the same materials were used, but steel boilers, shafts, and rods might be introduced with considerable advantage, embracing great strength with less weight.

Having alluded to the ordinary pressures at present used, it will be well now to advert to the expansion valves. These valves are of three kinds—throttle, slide, and tubular.

The motions imparted to the throttle valve are oscillating and revolving, the latter is now most generally adopted, but with this disadvantage, that the action is equal both for supply and cutting off.

The slide valves are of the ordinary and gridiron type, the latter may be said to be the better, on account of the stroke being so short in comparison to that of the former.

Tubular valves are tubes inserted in each other, with ports to correspond, a sliding or rotary motion accomplishing the desired effect. The motions imparted to these several valves are generally uniform, either by mitre gearing or eccentrics, consequently the action of the valves is not perfect. The proper motion for an expansion valve is to open gradually and close suddenly; to obtain this the old but correctly working cam must be resorted to; this useful arrangement is too often discarded to make place for newer but less correct productions. It may of course be urged that the cam is not applicable for high velocities, but undoubtedly its use might be attained by introducing stiff gear and perfect equilibrium double beat valves; by dividing this valve centrally a more correct action can be attained, in relation to that of the steam, on the valve whilst closed and open. The merits and demerits of the expansion valves here alluded to are almost equal. The ordinary throttle-valve has less friction than any yet introduced, but it possesses the great evil of throttling the steam when closing; also when this valve is worked by levers, or has a vibratory motion, should the stroke be lessened, the full area cannot be attained. The last evil is dispensed with in the remaining example, as the ports or openings are much larger than required when the valve is at full stroke, and not too small when the least motion is given. The friction of the gridiron iron valve is perhaps in excess of the other examples, as in the case of the tubular valves the action of the steam is neutralized. The means adopted for altering the grades of expansion valves whilst in motion are various. A spiral motion is the one universally adopted, and there is not the least doubt it is correct.

I will now call attention to the following description of an expansion valve and gear which I have designed for high velocities:—A cylindrical casing has within it projections at given positions; two of these projections act as spaces between the ports of ordinary tubular valves. The valve now explained is tubular, but the area centrally is half of that of the ends, which are parallel for given lengths, due to the stroke of the valve. These parallel lengths also regulate the neutrality of the valve whilst in action. At the present time the means adopted to impart the motion is a disc of metal with a circular slot; within this slot is a brass nut into which is screwed a pin. The connecting rod of the valve is attached to the pin in the ordinary manner. The means for altering the grades of expansion is by loosening the pin by its handle, and allowing the nut to slide in the slot to the required position. It is almost needless to add that the steam enters at the side of the casing, and escapes around and through the valve, keeping it in equilibrium.

The valves next in requisition are those for the ends of the cylinder, commonly known as relief valves. The usual kinds adopted are discs, with springs or weights to resist the given pressure of the steam. The action of these valves is, of course, due to the excess of pressure within the cylinder over that of the resistance caused by the springs or weights. It has been proved that in the case of excessive priming of the boilers the cylinders are suddenly flooded; in order to release the water, cocks are sometimes used, but in many instances the springs or weights are lifted by levers. Now, in the case of cocks, if not provided with valves beyond them they must be worked by hand at each return stroke of the engine, or the vacuum will be destroyed. The spring valves will close naturally, or by the spring on its release from the hand lever. High-pressure steam has been lately introduced, with great advantage, in the place of springs, but with an entirely differently-arranged valve and casing.

I have arranged a relief valve, so that the spring is not tampered with by levers or hand power, and an instantaneous opening can be effected without cocks, &c. The spring valve has an opening in it centrally to receive on its outer side a flat disc, termed the vacuum valve. On the inner side is a provision mitred to receive a solid disc valve, which, on being pressed inwards by a spindle and lever, allows a free exit for the steam and water; on a vacuum being caused the vacuum valve, which is guided on the spindle alluded to, closes the opening air-tight; by this it will be understood that the spring has not been in requisition, but on closing the inner disc the spring valve becomes one of the ordinary kind. Previously to starting the engines it is well known a vacuum should be caused in the condensers, also the cylinders and slide casings should be warmed, and the condensed water be allowed to escape through the relief valves or cocks.

The valves used for the purpose alluded to are termed the "blow-through valves." It may be here observed that, in some cases, the ordinary plug cock is preferred for this purpose. When valves are introduced, they are generally of the ordinary disc kind, but one firm adopts a common slide valve for the purpose, with the advantage of simplicity of levers, &c., and easy manipulation.

The piston-rods of marine engines are subject to excessive strain; consequently, the use of guides is imperative. For the single piston-rod engine, the universal system is a channel underneath the rod, the guide-block being generally of gun metal, and the upper portion attached to the piston-rod by bolts and nuts. For double piston-rod engines, the guides are of two kinds: the first arrangement is as the last, and the second, as for high-pressure engines, or double guides. To say which is the preferable mode of arrangement of guides will, perhaps, be deemed bold, but I may venture to state that I deem that for the single piston-rod the best of any yet introduced.

I cannot close this portion of the present paper without alluding to the admirable arrangement for tightening the gland of the piston rod stuffing-boxes, introduced by the firm of Messrs Maudslay, Sons, and Field. The screws are of the ordinary kind, but, in the place of nuts, worm wheels are used, worms being fitted to correspond; and motion can be given by a box-spanner while the engines are at work. This is one of the most important improvements tending to accelerate the progress of a ship during a voyage, say three or four months. Imagine the engines requiring stoppage during a gale in order to tighten the glands, and a fair estimation can be formed of the value of the improvement alluded to.

Having commented, though somewhat briefly, on the cylinder appendages, attention may now be given to the main frames and crank-shaft. The main frames may be said to undergo a continuous strain, and must, consequently, be of a certain strength in order to preserve the requisite rigidity. The cylinder is attached to the one end, and the condenser at the other, whilst the crank-shaft has to be supported in its bearings. Not many years ago a celebrated firm used to make the condenser and main frame in one casting: since that, we have had the well-known

frame like the letter A laid on its side, also the hollow frame, with a raised projection for the crank-shaft, and a stay from the upper portion connected to the cylinder; this last may be said to be the most simple, and, at the same time, of less material than the A frame. As before stated, the strains on the frames are continuous, yet, when sudden shocks occur, from the racing of the engines or priming of the boilers, the tenacity of the cast-iron is severely tested. As this is the case, wrought-iron might be used with great advantage, both as to increase of strength and decrease of weight. The crank-shafts of marine engines are generally of wrought-iron, in one mass, the cranks being double, and forged with the shafts. Three bearings are deemed imperative, so as to equally distribute the strains. Now, this is correct in theory and practice, and the writer will be deemed committing a grave error no doubt, in mathematics, when he assumes that the forward frame and half-crank can be dispensed with, in order to reduce the weight and material. He is, of course, aware that the thrust and pull of the connecting-rod will be thrown on the centre crank and bearing, but, in order to counteract this, the length and diameter of the shaft at that part should be increased. He would also prefer, in this case, to extend the frame and connect the upper portion to the condenser; the cap being on the top instead of at the end, as now used. Screws might be employed to adjust the side brasses; the eccentrics could be within the cranks, or between them and the bearings.

Having alluded to the principal working details, I will now lay before you a description of the mode of condensation—past and present. It is well-known that the principle of condensation is to convert the steam into its original state. The contact of the cool fluid, in the shape of water, accomplishes this in the ordinary condenser, and cooling surfaces in the surface condenser.

In the days of the introduction of side lever engines, the arrangement of the condenser and air-pump was faulty; in some cases the foot-valves were almost inaccessible. Not many years ago, being on board a steam-ship fitted with old side lever engines, which were then undergoing repair, I noticed a rope and block tackle over near the condenser. On inquiring of the engineer how he progressed, the answer was, "I am just going to sling one of the men with this tackle, by the heels, to inspect the foot-valves; and that," said he, "is no foolish job." On further examining the engines, I found that an upside-down attitude was required, and indeed the only one allowed for the inspection of the valves in question. Happily now, however, such an inconvenient arrangement is of rare occurrence. We also find the side lever engine is being superseded by that of the oscillating type.

The arrangement of the ordinary condenser and air-pump for oscillating paddle-engines is generally as follows: the condenser is situated between and below the trunnions of the two cylinders; the air-pumps are at an angle, with trunks and connecting rods of the ordinary kind; the foot-valves are at the bottom of the barrel of the pump, the piston has valves in it; and the discharge-valve, when not at the top of the pump-barrel, is at its side. Now, the principal defects in this arrangement are in the position of the valves and condenser. When the foot-valves are directly underneath the pump's piston, it is obvious that an almost entire disconnection must be made to inspect them. Also, in the case of the piston-valves requiring inspection, the pump-cover must be removed, and to attain this the gland packing has to be slackened, and the connecting rod disengaged. Now, to avoid these evils, doors might be introduced, but with these disadvantages—increased height or length of the air-pump passages, and a body of water always above and below the piston, which undoubtedly is what any right-thinking engineer would disapprove of, it being clearly understood that an air-pump will produce a better vacuum when the piston thoroughly discharges the contents between the foot and delivery-valves at each stroke.

Having thus pointed out the existing evils of the ordinary arrangement, it will not be deemed out of place to introduce a remedy. The condenser at the side of, or below, the pump is in one of the worst positions that can be conceived; the idea of allowing the condensed steam to fall, only to be raised again, seems, on consideration, to be foreign to the ideas of our talented engineers. It is well known that, in ordinary arrangements, the condenser is always in the position alluded to; steam even of a low pressure is larger in volume, but not as dense and heavy as water; it is also more elastic, hence it will more readily ascend. This, then, being clearly understood, it is not unwise or impracticable to assume, that if the condenser were on the top of the air-pump, instead of at its side or bottom, a better vacuum would be maintained. I beg to offer a description of an arrangement of condenser and position of the valves, both for correct action and accessibility. It will be understood that the condenser in this case is over the air-pump; the suction-valves are inverted, consequently the weight of the water assists the action of the piston in causing a vacuum. The exhaust-steam from the cylinders rushes up the exhaust-pipe, and enters on the top of the condenser. The water in the air-pump is discharged through the delivery-valve, at the top of the pump, and from thence through the delivery-valve at the ship's side. A door is secured opposite the delivery-valve, and doors are provided on each side below the bottom of the condenser, for the double purpose of inspecting the suction-valves and the air-pump piston.

This arrangement of condenser and air-pump will occupy as little room as those of the ordinary kind, with the advantage of accessibility to all the working parts without disarrangement. It may be argued that the stuffing-box, being in a recess when used for guides, would be troublesome to keep tight or repack, but if oil be always kept in the recess, so as to entirely cover the gland, it would tend to lessen the liability of leakage; the nuts of the gland and bolts could be adjusted by a box-spanner, or the bolts prolonged to the top of the condenser. In cases where the depth of the ship would admit, the recess could be dispensed with; trunks are not proposed for this arrangement, as their diameters would be necessarily increased, owing to the length required to pass through the condenser, unless a recess were resorted to as now proposed.

The next portion of the subject now before us is the ordinary condenser for screw engines. The action of the air-pump in this case is usually horizontal, consequently the valves are at right angles to the pump. To describe each arrangement of condenser and air pump that have come under the writer's notice would occupy too much time, consequently a brief mention of two or three examples on this occasion will be deemed sufficient. For direct-acting and trunk engines, with the cylinders secured together or side by side, the condensers were between, and, in some instances, in front or at the sides of the air-pump. The foot and discharge valves were directly over each other, the former under the pump at each end, the condensed water or steam being drawn through the foot valves and forced through those above. In another instance the foot and delivery valves were extended the entire length of the air-pump and passages, the position of the valves over and under being as before, and the condenser being between the air-pumps. For return connecting rod engines, the condenser and air-pumps are subject to great disadvantages. In order to obtain a passably good arrangement, and, at the same time, occupy a moderate space in proportion to those last mentioned, the condenser, &c., have to be shaped to suit the purpose required. It must be perfectly understood that when the piston rods are beyond the crank shaft (as in the examples now in question) there is a certain amount of space required for the piston-rods and guides of the cross head, or guide block, whichever may be used. It is also clear that accessibility to all the valves without disarrangement should be attained. To illustrate these desiderata the following examples will be sufficient for

the present purpose:—In one instance the condenser is partially between the cylinders, and extending beyond the crank shaft; the air-pumps are at the side of the condenser; the suction-valves extend the length of the air-pump; and the discharge valves are between each pump, the pump and the valves being beyond the crank shaft.

The next example is as follows:—The condenser and its appendages are entirely beyond the crank-shaft. The air-pumps are at the extremity or sides and near the bottom of the condenser. The foot and discharge valves extend the entire length, and are arranged over and under the pumps in the usual form. The guides for the piston rods are between the upper portion of the condenser and that of the discharge chamber.

Having disposed of the principal arrangements of air-pumps and condensers as formerly constructed, allusion will now be made to those of recent improvement and practice. As before stated, a better vacuum can be attained when the condenser is over the air-pump instead of at the side. For direct-acting engines there are two arrangements specially worthy of notice. 1st. The air-pumps are worked by the steam-pistons between the cranks as near the base lines of the engine as the periphery of the circles will admit, the condenser being one chamber, directly over the air pumps. The suction valves are inverted in the bottom of the condenser, so as to effectually drain the same. The discharge chamber extends the entire length on each side and back end of the condenser, the valves being nearly in the same line as those for the suction, but reverse in action. The next example is the same as the last in principle, although different in arrangement. The air-pumps are situated as in the last example, but the condensers are separate, one to each engine, over and on each side of the air-pump. The suction valves are inverted in the bottom of each condenser to obtain the advantage before alluded to, the discharge chamber and valves being central or between each condenser, and directly over and between the air-pumps. It may now be argued, that if the two examples last mentioned are perfect in action and arrangement, what is the cause of the diversity? The answer to this is, Diversity of idea. Engineers, as a rule, are averse to the act of copying from each other. No sentence grates more harshly on the ear of a scientific man than the words, "Where did you copy this," or is more repugnant to his dignity.

Having referred to the improvements in the arrangement of condensers, &c., for direct-acting engines, attention will now be given to those adopted for double piston-rod engines. It must be borne in mind that for this class of engine the prolongation of the piston rods beyond the crank-shaft greatly deteriorates the arrangement of the air-pumps and condensers, in relation to the space occupied by those for single piston rod engines. In the examples now given, the air-pumps are worked by the steam piston, and as near the base line as possible. The condensers are separately arranged outside the guides of the piston rods of each engine; the suction-valves are inverted above the top of the air-pump, as in the last examples; the discharge chamber is between the air-pumps and the valves, on the same level as those for the suction. It will thus be understood that both suction and delivery are at the side, over and extending the length of each air-pump, instead of being directly over them, as in some cases.

The next example worthy of notice is arranged as follows:—The condensers and their appendages are beyond or outside the guides of each engine, the air-pumps deriving their motion as in the previous examples, and are as near the base line as possible, so situated as to clear the guides. Partially over and beyond the side of each air-pump are the discharge valves, above which is the discharge chamber; over this, and at the side of the same, is the condenser with the suction valves inverted.

I will now allude to the system of condensation known as surface condensation. Mr. Hall, in days of yore, introduced the tubular arrangement with great advantage. Engineers at that time were slow in appreciating the then presumed gain, and it is only lately that we have seen the surface condenser universally adopted by the powers that be. To condense steam properly is undoubtedly to reduce it to its natural or original state. Now, in the ordinary condenser we bring water into actual contact with the steam to condense it. Surface condensers are to be recommended, particularly for one reason, viz., the production of distilled water for the feed of the boilers. The arrangement of the tubes in surface condensers entails practical difficulties as to the position most suitable, whether they be inserted transversely, perpendicularly, or longitudinally, of the hull of the ship, renewal of the tubes being often required (sometimes while at sea) from corrosion.

The means adopted to render the connection of the tubes in the plate air-tight are numerous. The usual mode now is—india-rubber rings recessed in the plates encircling each tube—compression being obtained by a nut for perpendicular tubes, and by the vacuum in the condenser for those of horizontal positions;—this is simple and efficacious, and at the same time economical. It must here be remarked, however, that compression of the india-rubber by vacuum can only be attained when the steam is condensed by the external surface of the tubes or within the plates. The circulation of the water is either through or surrounding the tubes, and is produced by pumps with plunger-piston or centrifugal action. The position of the piston-pumps is horizontal, motion being derived either from the steam-piston or piston-rod. The centrifugal-pump requires a separate engine, or spur-gearing, &c., from the crank shaft to give the required velocity.

The values of the two arrangements now used for the condensation of the steam are about equal. In the case of the water surrounding the tubes, the steam passes through the same, and in the case of the steam surrounding the tubes the position of the water is reversed.

It is obvious that where internal condensation is effected a greater number of tubes are required, in relation to those of the external system—the inner surface of the tube being less than that of the outer. The advantage gained by the steam entering the tubes may be said to be—access for cleaning without disarrangement. Injection, or ordinary condensers, are more generally used than those of the surface kind, on account of economy in the outlay of capital at the commencement.

The injection-valves for ordinary condensers are generally of the solid or gridiron type, the latter to reduce the stroke to open and close. The pipe for the dispersion of the water is usually a tube, with apertures, of an elongated or circular form. An improvement has lately been made in these pipes, by contracting the area for one-half the length, thus equalizing the diffusion of the water throughout.

The next valve necessary for the condenser is the snifting valve, which is a single disc of gun metal, with a slight spiral spring at its back, or upper part. A screwed spindle is universally used to prevent the valve from rising, after the water and air in the condenser has been blown out previously to starting the engines. It might be deemed neglectful if I were not to make allusion to the bilge injection-valve or cock, whichever may be used. This valve, as well-known, is only required in cases of necessity, such as leakages, or disarrangement of the bilge or donkey pumps. I would beg to suggest that the bilge water should not be allowed to enter the condenser, on account of the generally impure state of the bilges. A valve and box might be arranged at the end of the air-pump for this purpose.

The portions of the marine engine next for exemplification are the feed and bilge pumps. The position of these is so arranged that a free access can be obtained to the valves and surrounding parts without disarrangement. Some makers prefer to work the feed and bilge pumps in a line with each other, with one rod and plunger direct

from the steam-piston. Other firms secure the pumps side by side to the discharge water-pipe of the condenser, each plunger being connected to the piston-rods crosshead; this latter improvement is more general than the former. In the case of hollow plunger or trunk air-pumps, those for the feed and bilge are on each side of the air-pump, and secured by nuts or keys. Before terminating this portion of the subject, it will be well to add that the valves for the air, feed, and bilge pumps are now univerasily discs of India-rubber, instead of the gun-metal spindle-valves.

It will have been observed that no allusion has yet been made to the arrangement of combined high and low pressure engines. For the purpose of comparison I will allude only to those arrangements in common use. The position of the low-pressure cylinders is side by side, as for those of the ordinary kind; in some cases annular cylinders are used, viz., the high-pressure cylinder within that for the low pressure. Another arrangement is the high-pressure cylinder on the top of that for the low pressure. A third arrangement has the smaller cylinder at the back end of the larger. A fourth example consists of two high-pressure cylinders in front of one for low pressure, the former acting as guides for the piston-rod. The means adopted for imparting the motion of the piston to the cranks are of the ordinary arrangements already described, with the exception of the necessary extra piston-rods and stuffing-boxes.

Having alluded to the different engines, and their details past and present, adapted for the single screw, I will now call attention to a notice of arrangement of engines as at present used for the twin or double-screw system. It must here be mentioned that the class of engines now under notice have precisely the same duty to perform as those before described, consequently, if I pass over the major portion of the detail it is to avoid repetition.

The arrangement of the engines is usually separate for each screw. The type of engine generally adopted at present is direct-acting with surface or injection condensers. Single piston-rod engines seem to be more in favour than those of the double piston-rod return action type, I presume on account of the simplicity of the former. The position of the arrangement in plan is side by side—port and starboard—instead of directly opposite each other; this is owing to the space required for the arrangement adopted, and the small beam of the vessel; but in some cases engines are arranged opposite each other, with a great reduction of space compared to that of the side system. When the crank shaftings are connected the steering principle is destroyed, and the twin screw system, so far as regards propulsion, is very little better than the single system.

There is not the least doubt that as a mode of steerage the twin system is correct, and for shallow draughts it is advantageous. To suppose the plan to be universally correct for large vessels requires, however, more practical evidence than I at present possess; but of this I am confident, that for small or large vessels, whether for commercial or war purposes, the twin screws, when driven separately, are invaluable for steering. The advantages for war ships are principally the facility for manœuvring when under an engagement. Let it be presumed that the enemy has aimed at a twin-screw steamer, by a contrary action of the screws her position can be shifted instantaneously, and the intended evil postponed, if not averted.

I have come to the end of my brief description of the marine engine, and will now allude to the weight of material, cost of marine engines, and the relation of nominal to actual horse-power, together with the consumption of fuel. The variation in the weight of marine engines is due to the design and arrangement as much as the material used. Double trunks may be said to be a fair example as to the average weight of marine screw engines. Return connecting rod engines are perhaps the heavier, in comparison to those of the single type, in relation to rods and guides. High and low pressure engines combined are the heaviest of any examples yet given. The materials comprising the different portions of the engines of the present day are of six kinds—first, cast-iron, of which is formed the cylinders, pistons, valves, casings, main frames, guides, condensers, &c.; secondly, wrought-iron, comprising cranks and shaft, piston and valve rods, links, levers, weigh-shafts, bolts, nuts, &c.; thirdly, steel for springs, small pins, &c.; fourthly, gun metal for bearings, guide blocks, bushes, glands, nuts, &c.; fifthly, copper, for pipes of all kinds required for steam and water; sixthly, india-rubber, for valves, packing, &c. For the present occasion, in reference to weight, I have selected twelve examples of marine screw engines, each varying in power and design. The examples of arrangement being in pairs, the result has been that 4·334 cwt. per nominal horse power may be taken as the average weight of material, exclusive of boilers, fittings, screw-propeller, and alley-shafting. It may here be observed that each maker of marine engines in the present day differs in design and arrangement, consequently the weight of trunk engines by different makers would be unequal. The same may be said for single piston rod engines, as well as for double piston rod return connecting rod engines.

I now come to that portion of this subject which is the crowning question of all, and too often the cause of much controversy in political and commercial circles, viz., what is the cost? My opinion is, that it is perhaps the most difficult query to answer that could be put, and the only reason for its introduction is to preserve myself from presumed neglect in not noticing this important matter. To ascertain correctly which is the cheapest class oi engine at present in use, is a problem much too difficult for me to solve; but I will, however, tender such information as I deem reliable.

The price of a marine engine depends entirely on the class of workmanship. Should a roughly-finished engine and boiler be required, with more painted than polished surfaces, the cost will be reduced in comparison to that of the more highly-finished. The fittings also greatly regulate the outlay. Some companies pride themselves on this portion of display, others, again, look on it as an unnecessary expense; so, to draw a correct line of comparison would involve the amalgamation of the many ideas in order to give a fair evidence. I feel confident, however, that marine engines, with boilers and fittings complete, can be produced of certain classes, for £70 per horse-power nominal, and the same can be reduced to £50 per horse-power, each price of course being under certain conditions as to terms and workmanship.

Allusion must now be made to the power, &c., of marine engines. Nominal power is a term used particularly for commercial purposes. Each maker has his private rule, hence the difference in dimensions in engines of the same class and power. Actual horse-power is defined by the indicator diagram, speed of piston, &c.; the ratio between the nominal and actual power is in some cases low, in others high. The writer has known instances where, the nominal power being 1·0, the actual was 6·0; and in others, nominal 1·0, actual 2·123; the average ratio at present is nominal 1·0, actual 4·0 to 5·0. With reference to the consumption of fuel, there is a great difference in the evidence. Superheating and surface condensation are slowly making progress, and at the same time reducing the consumption of fuel in ratio to the amount of water evaporated or steam used. The average actual horse-power expended per cubic foot of water evaporated is, water being 1·0, actual horse-power 2·635 to 4·0, and doubtless in some cases more. The ratio of fuel consumed in lbs. per hour, to the actual horse-power per hour expended may be taken as follows:—Engines of ordinary construction, power, 1·0; fuel, 5 to 6. For expansive working-engines, with superheating and surface condensation, thus:—Power, 1·0; fuel, 2·50.

I am deeply indebted to several eminent firms for

Twin Screw Propulsion.—Tabular Statement of Ships, Marine Engines, &c., constructed by Messrs. Dudgeon, Blackwall, since 1851 to the present date, supplied by the Firm.

Beam of Vessel.	Length.	Depth.	Tonnage.	Immersion.	Nominal horse power.	Diameter of cylinder.	Length of stroke.	Kind of condensor.	Diameter of air-pump.	Diameter of screw propeller.	Pitch of screw propeller.	Distance between centres of propellers.
ft. in.	ft. in.	ft. in.	tons.	ft. in.		inches.	inches.		inches.	ft. in.	ft. in.	ft. in.
22 6	150 0	13 0	395	9 0	120	26	21	Injection.	$8\frac{1}{2}$	7 0	14 6	8 9
23 0	165 0	13 6	425	,,	,,	,,	,,	,,	,,	7 5	,,	,,
,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
34 0	225 0	22 0	1,258	17 0	150	H. 24 L. 50	24	,,	12	8 10	16 0	11 8
25 0	175 0	15 0	531	9 6	200	34	21	,,	11	8 3	16 0	10 5
23 0	165 6	13 0	425	9 0	120	26	21	,,	$8\frac{1}{2}$	7 0	14 6	8 9
,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
11 10	57 6	7 0	35	4 10	30	12	11	High pressure.	None.	3 8	7 4	4 6
23 6	200 0	13 4	546	9 6	200	34	21	Injection.	11	8 0	16 0	9 5
15 0	85 0	6 6	91	2 9	30	12	11	High pressure.	None.	3 6	7 4	4 6
,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
34 0	265 0	28 0	1,500	16 0	350	H. 31 L. 62	24	Surface.	11	10 6	18 0	12 0
17 0	100 0	6 6	138	3 6	30	12	11	Injection.	$5\frac{3}{4}$	4 0	7 6	5 4
32 0	160 0	13 3	737	10 0	200	34	21	,,	11	8 0	16 0	9 5
24 6	200 0	13 4	592	9 6	,,	,,	,,	,,	,,	,,	,,	,,
28 0	250 0	15 6	972	10 0	300	40	$22\frac{1}{2}$	,,	13	9 2	17 3	10 9
,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
27 0	230 0	14 6	829	9 6	250	37	21	,,	12	8 9	16 0	10 0
21 6	190 0	13 0	436	10 0	120	26	21	,,	$8\frac{1}{2}$	7 0	14 6	8 9

Tabular Statement of Marine Engines Constructed by Messrs. John Penn and Son, Greenwich, supplied by the Firm.

Screw Engines.

	Minotaur.	Achilles.	Warrior.	Black Prince.	Resistance.
Diameter of cylinder............	$104\frac{1}{4}$	$104\frac{1}{4}$	$104\frac{1}{4}$	$104\frac{1}{4}$	$70\frac{3}{4}$
Length of stroke	4 ft. 4 in.	4 ft. 0 in.	4 ft. 0 in.	4 ft. 0 in.	3 ft. 6 in.
Revolutions per minute.........	—	$52\frac{1}{2}$	$54\frac{1}{4}$	$51\frac{3}{4}$	68 to 69
Diameter of screw	24 ft. 0 in.	24 ft. 0 in.	24 ft. 6 in.	24 ft. 6 in.	18 ft.
Pitch of ditto	25 ft. 6 in.	25 ft. 6 in.	30 ft. 0 in.	30 ft. 0 in.	21 ft.
Nominal h.p.	1350	1250	1250	1250	600
Indicated h.p........................	—	5746	5471	5146	2424
Speed of ship	—	14·25 knots	14·35 knots	13·31 knots	11·84 knots
Date of trial	—	Dec. 28, 1864	Oct. 17, 1861	Aug. 30, 1862	Sept. 23, 1862

Paddle-Wheel Engines.

	Exploratore.	Taliah.	Izzeddin.	Victoria.	Prince Imperial.
Diameter of cylinder	72 in.	72 in.	66 in.	58 in.	$52\frac{1}{2}$ in.
Length of stroke	5 ft. 0 in.	5 ft. 0 in.	5 ft. 0 in.	4 ft. 6 in.	4 ft. 0 in.
Revolutions per minute..........	40	39	$41\frac{1}{2}$	42	48 to 49
Diameter of axis of wheel......	19 ft. 0 in.	19 ft. 0 in.	17 ft. 6 in.	17 ft. 6 in.	14 ft. 11 in.
Length of floats	10 ft. 0 in.	10 ft. 0 in.	10 ft. 0 in.	7 ft. 10 in.	8 ft. 0 in.
Depth of ditto......................	4 ft. 6 in.	4 ft. 6 in.	3 ft. 10 in.	3 ft. 6 in.	3 ft. 2 in.
Nominal h.p.	350	350	300	220	180
Indicated h.p.......................	2556	2540	2373	1640	1480
Speed of ship	17·27 knots	17·74 knots	16·5 knots	16·83 knots.	16·3 knots
Date of trial	May 6, 1863	Dec. 28, 1863	Sept. 19, 1864	Sept. 3, 1861	Sept. 28, 1864

The following is a list of engines constructed by Messrs. Maudslay, Sons, and Field for H.M. Navy since 1851 to the present date, kindly furnished by Joshua Field, Esq.:—

			Horse-power Nominal.
Engines, &c., for	75 Screw Vessels........................	Total	37,570
,,	26 Paddle ,, ...	,,	6,340
,,	69 Screw Gunboats.................	,,	4,260
		Total	48,170

The following Table gives Particulars of some of the Principal Marine Engines, recently constructed by Messrs. R. Napier and Sons, Glasgow.

NAMES OF VESSELS.	Paddle or screw.	Material.	Tonnage. O. B. M.	Kind of Engine.	Number of cylinders.	Diameter of cylinder.	Length of stroke.	Nominal horse power.	Kind of Boilers.	Kind of Propeller.
						inches.	ft. in.			
Coromandel	Screw	Iron	—	Plunger, direct.	2	50	2 6	250	Tubular.	Common.
Gunboat for H. E. I. Co.	"	—	—	Horizontal, high pressure.	2	18	1 6	80	Tubular.	"
Emperor Alexander	"	"	—	Plunger, direct.	2	60	3 0	350	—	"
Islesman	"	"	$197\frac{81}{94}$	Horizontal.	2	$24\frac{1}{8}$	3 0	80	Tubular.	"
Victoria	Paddle	Iron	$144\frac{76}{94}$	Oscillating.	2	$27\frac{1}{16}$	3 0	44	"	Radial.
Fifeshire	"	"	—	Inclined.	2	$36\frac{1}{8}$	3 6	82	Lamb's flue.	Eccentric.
Chevy Chase	"	"	$963\frac{3}{94}$	"	2	$72\frac{1}{8}$	8 0	416	Tubular.	"
Royal William ...	Screw	Wood	—	Plunger, direct.	2	$65\frac{1}{8}$	3 0	500	"	Griffiths.
Cormorant	"	Wood	—	Plunger, direct.	2	$45\frac{1}{8}$	2 0	200	"	Griffiths.
Scotia	Paddle	Iron	$4050\frac{28}{94}$	Side lever.	2	100	12 0	1000	"	Radial.
Orestes..............	Screw	Wood	—	Plunger, direct.	2	$60\frac{1}{2}$	3 0	400	"	Griffiths.
Clan Alpine	Paddle	Iron	$1507\frac{30}{94}$	Inclined.	2	64	8 0	400	"	Eccentric.
Wolf	"	"	870	"	2	61	6 0	275	"	"
Rolfe Krake	Screw	"	$1091\frac{13}{94}$	Horizontal direct.	2	48	2 0	235	"	Griffiths.
Osman Ghazy......	Screw	"	$4221\frac{81}{94}$	Horizontal direct.	2	92	4 0	900	"	"
Abdul Aziz.........	"	"	$4221\frac{51}{94}$	"	2	92	4 0	900	"	"
Orkman	"	"	$4221\frac{51}{94}$	"	2	92	4 0	900	"	"

Total number constructed by this firm, from 1851 to 1864 inclusive—Screw engines, 87; Paddle engines, 39.

their courtesy and the practical information received and personally given. Messrs. John Penn and Son, of Greenwich, have kindly given me a tabular statement of much value to the profession and the Society. I am advised by this firm that a more extensive list of their trunk engines may be found in the *Artizan* journal for March, 1859, and November, 1861. The list now presented commences from the latter date; also that with their class of engines the consumption of fuel is about 4lbs. per actual horse-power per hour for those of ordinary construction, and about 2·5 lbs. per actual horse-power per hour for expansive engines, with superheated steam and surface condensation. This firm has displayed a warm interest in the present paper, by kindly lending the photographs and splendid working models, which I have the pleasure of laying before you.

Messrs. Maudslay, Sons, and Field have kindly lent photographs of their late improvements in marine engines. From personal interviews, I am enabled to present the Society with valuable information, particularly as follows:—The amount of fuel consumed, per horse-power actual, for ordinary engines by this firm is 5lbs., in some cases less and in others more. For three cylinder expansive engines, with surface condensation and superheating, the consumption is reduced to 2·25 to 2·5 lbs. per horse-power actual. These engines cut off at one-seventh of the stroke producing an almost correct indicator diagram. In one example shown me, the nominal horse-power was 150; with a pressure of steam 25 per square inch, the indicator diagram produced a result of 875 actual horse-power, being in the ratio of 1 to 5·833, which may be said to be an exceptional result for screw engines. This firm has constructed, since 1851 to the present time, the following number of engines and boilers:—Of screw engines, 183; of paddle-wheels, 30. The highest nominal power of one pair of engines yet constructed by this firm is 1,350, and the lowest 10.

The Messrs. Rennie have kindly lent me models and photographs of the different classes of engines they are in the habit of constructing. I am informed by this firm that the consumption of fuel for ordinary engines is — Actual horse-power 1, fuel 5. In the case of surface-heating, surface-condensation, and expansion—Actual horse-power, 1, fuel consumed 2·5; showing a reduction of 50 per cent. on that of the ordinary kind, which is about equal to the other firms.

Valuable statistics have been supplied to me by Messrs. R. Napier and Son, of Glasgow, giving particulars of the ships, engines, &c., constructed by them from 1851 to the present time. From these I have made a selection for publication. This firm has also kindly presented me with splendid photographs of their engines, &c., which are hung for inspection.

With reference to twin-screw propulsion, I am deeply indebted to the firm of Messrs. Dudgeon, of Blackwall, they having kindly furnished for this occasion practical statistics of the proportions of vessels and engines constructed by them since the year 1851 to the present time.

In conclusion, I must apologise for the length of my present paper; but I beg to observe, that had I extended my remarks to twice or thrice the present length, I should even then have failed in doing justice to this subject, which is undoubtedly one of national importance. To the credit of those concerned it can be truthfully said, that, in comparison with other nations, the productions of our marine engineers maintain that high standard for excellency of design and workmanship which has ever characterised the natives of Old England.

DISCUSSION.

Mr. J. Clarke said allusion had been made to surface condensers, which, he presumed, would render unnecessary the use of salt water in the boiler, inasmuch as the boilers could be charged with fresh water before leaving the port, and this was used over and over again. He was recently in the workshop of a member of the Society, who was largely engaged in the manufacture of salinometers, having then a large order to execute for the Government, but in the event of the universal adoption of surface condensers, he presumed that instrument would be superseded.

Captain Jasper Selwyn, R.N., said, as a naval officer interested in the progress of mechanical invention, he thanked Mr. Burgh for the information he had afforded

in his interesting paper. He would remark, in the first place, that only very slight mention had been made of boilers; but a man who took the interest, as Mr. Burgh evidently did, in mechanical questions, would never ignore the source of the power, or deem it unworthy of a place in his paper; for it was clear, so long as we went on with ineffective arrangements to produce the power itself, it mattered little how much economy was introduced into the arrangements for utilising the power. The steam boilers of the present day he considered to be a reproach upon the marine engineers of this country. They were very far from producing at any time anything like the results in practice which they produced when sent on trial trips. That was partly caused by the insufficient means of securing the circulation of the water in the boiler, and partly by the bad arrangement of the fuel for firing, by the choking of the tubes with smoke, and by the galvanic action which was speedily set up, and resulted in the deposit of large quantities of material all over the heating surfaces. In many ways the boilers required, but had not yet received, the same amount of attention that had been given to the engines. He thought improved means for securing the circulation of the hot water, and of preventing escape, of utilising fuel, and obtaining complete combustion, were of more importance than any improvement in the engines. He had heard of the introduction of steel with great pleasure, knowing how advantageous it would be in many respects; but if those who employed steel did not consider the electrical action which would result when that metal was brought into contact with copper, a deposit would be produced in the boiler which would go far to neutralise the other advantages. He was very pleased to hear incidentally introduced into the paper a subject in which he had for some years taken an interest, viz., that of twin screws. He was, however, at a loss to conceive on what ground it was said that the twin screw principle could only succeed in vessels of a certain size, and was not applicable to larger ships. No later than the previous day the newspapers gave an account of the trial of a vessel of 970 tons, fitted with twin screws, and the results, he had been informed by persons who were present, were correctly reported. Now, that vessel represented what would formerly have been called a large ship, and the question to be decided was—to what tonnage were the good effects of twin screws to be limited? In the first instance it was said that the principle was a good one for boats; and last year Mr. Rennie stated it had been tried with excellent effects in small river steamers, but he doubted the success of its application to anything beyond that. Subsequently to that, however, blockade runners, fitted with twin screws, made their appearance, and were completely successful, and since then the experiment had been tried on a still larger scale by ship-builders on the Thames. He deprecated such a decision being arrived at on this point as would prevent us from building vessels for our navy of such steering power as Mr. Burgh had recognised in the twin screws; besides this advantage, he (Capt. Selwyn) maintained there was also an increase of speed. They had a certain draught of water in a screw ship to which they were limited; they might put into the ship engine power as much as they pleased, but they could only utilise the area of water which came against the propeller. If they could increase that area they got more duty done by the engines without "churning" the water, and that was the whole theory of the success of twin screws in giving speed. That principle was perfectly applicable to a ship of war; and the vessel to which he had previously referred had another valuable quality: she gave, with a draught of nine feet six inches, a speed of $16\frac{3}{4}$ knots with both screws working, and of 12 knots with one screw only working. This showed that even in that vessel the power of propulsion was not utilised to its full extent; the increased velocity did not correspond to the increased horse-power used. With regard to the observations in the paper as to the reluctance of men to copy, he confessed he thought that class of intellect was more rare which knew how to judge properly what to copy, than that which invented for itself a new mode not always better than that which preceded it. The great masters in painting had numberless followers, who called themselves the scholars of those men; and it was no less a credit to these to have chosen well their master than to have produced something original. With regard to the comparison of fuel consumption, it must be recollected, when they got indicated h.p. in proportion to nominal h.p., as 4 or 5 to 1, and the coal burnt was now $2\frac{3}{4}$lbs., instead of 8 or 9lbs. per h.p., there was not so very great an advance as might be inferred from the way in which the case had been put. Much more might be done in the way of economising fuel, by due consideration of the best way of placing the heating power advantageously in the boiler. It was clear, so long as they did not provide for the free descent of the hot water when it had given off its steam, and had become to a certain extent cool—the free descent from the top to the bottom to be re-heated, so long they lost the good effect of the boiler. The injurious effects of scale in boilers had been obviated to a certain extent by the employment of scale catchers or surface apparatus for laying hold of the scale as it floated up, but he thought the better way was to consider any system which formed less scale in the boiler, and with that view fresh water when once in the ship might be maintained in the boiler without trouble. They could produce sufficient fresh water for the purpose by the utilisation of a small quantity of fuel so as to supply whatever waste of water took place from condensation. With regard to the general arrangement of engines in ships, he quite entered into the graphic illustration in the paper of a man hung by his heels to inspect the foot valves. He thought engines were made too much like watches. Engineers prided themselves on the small space within which they could place their engines, and by that means subjected the persons who worked them to a great deal of unnecessary inconvenience.

Mr. Rochusson, as one practically connected with the manufacture of machinery, would express his dissent from the statement of the last speaker— that the contact of steel and copper in a boiler would generate a stronger galvanic current than that of iron and copper.—[Captain Selwyn said he had made no such statement.]—There was no doubt that steel was a very important element in all engines, and he regretted that subject had not been more dilated on in the paper; at the same time, it was well to give a caution as to the indiscriminate adoption of steel for boilers. Steel would bear a higher tension that the best Yorkshire iron, but certain qualities of steel were unfit for boilers from their liability to injury from blistering. The most suitable form of steel for boilers was cast-steel, which could be made of a strength equal to a pressure of 60 tons to the square inch. One great object sought in engines was the avoidance of heated bearings; and the more they reduced the surface of the bearings, and the more they employed metal capable of a highly polished surface, the less were they liable to this evil. The use of cast-steel for shafting was, therefore, a great advantage. It had been found by experience that a cast-steel shaft of nine inches diameter was equal in strength to one of 11 inches in wrought iron. In that proportion, therefore, they saved material in the weakest part of the ship, and they had a stronger construction with less strain upon the engine. They might go from that to cast-steel propellers. There was scarcely a greater annoyance on a voyage than the breaking of a propeller. In one short voyage in one of his vessels, no fewer than five cast-iron propellers were broken. They were not, perhaps, at that time quite up to making good cast-steel propellers, but he believed they were so now. The first cost would be greater, but that was more than compensated by the safety and durability which were insured.

Captain Symonds, R.N., reverting to the subject of the twin screw, said that Mr. Burgh, while giving credit to that system for a certain number of advantages, had omitted two or three of the most important. During the last five or six years he had seen something of the practice of the larger class of twin screw vessels, and it struck him that one of the principal advantages of the twin system was that in the event of one engine or one screw becoming injured, they had the use of the other engine and screw, by which two-thirds of the power could be obtained in case of emergency. This was exemplified in the trial of the vessel alluded to by Captain Selwyn, when one of the engines being stopped, owing to heated bearings, she was propelled at twelve knots with the other engine; her full speed being rather over sixteen knots. That was a very important thing, especially in a merchant ship, as had been proved in a voyage to America. A twin screw ship had been able to proceed with fair speed and slight consumption of fuel with one engine, while the other engine was being repaired; so that when she arrived out her engines and boilers were in a good condition to run the blockade without any occasion for delay. If that ship had had only one pair of engines applied to a single screw it would not have been so capable of performing this service. With respect to the limit of size of ship to which the twin system was applicable, his gallant friend Capt. Selwyn's remarks on the subject rendered it unnecessary for him to go over the same ground again, but he would add that it was of the utmost importance to have the twin system adopted in heavy ships in order to divide the power between two engines, which ordinary engineers would then find no difficulty in manufacturing; besides, it was found difficult on board ship to lift out the heavy parts of very large engines for repair. He submitted also that the moving parts of these large engines in heavy ships were not so convenient as lighter machinery would be. Another great point was the difference in the amount of friction between the heavy single screw engines and the lighter engines on the twin system. In addition to these advantages, there was that which was derived from the position of the twin screws, away from the centre of the ship, which not only gave them a great advantage in propulsion, but also placed them away from the extreme end of the dead wood, where, from the longer leverage, greater vibration would necessarily be produced. In fact, the single screw produced an amount of vibration which was avoided in the twin screw system. Experience had shown that the twin principle had been applied with the best results to vessels of various sizes up to 500 tons, and within his own knowledge one of these vessels had been doing regular work in towing for the last six years. With a draught of only 3 feet 3 inches, and engines of 30 horse-power, she had been continually towing four Dutch barges, with loads of 50 tons each, at six knots an hour, which was a result, he believed, seldom obtained by paddle-wheel tugs of the same power and draught of water. The engines were in as good a state as when they were first built, and they had never been known to hang on the centre, which was one of the objections to the single screw engine. He had found the twin system effective for two main reasons. In the first place, the arrangement of the inverted cylinder engines on the A frame occupied no more room in the ship than a pair of ordinary screw engines, with this further advantage, that it did away with even the slight vibration which was found in vessels of the same character with the engines laid horizontal. He submitted these were points of advantage which ought not to be lost sight of

Mr. G. F. Wilson, F.R.S., remarked that on the first introduction of surface condensers a difficulty was experienced, which he should be glad to hear had been obviated. It was found that the oil used for lubricating certain parts of the engine was carried with the water into the boilers, and there, as was well known to chemists, when oil and water were brought together at a high temperature, the oil became separated into its acids and base, the acids being free to act upon the material of the boiler, and upon any impurities contained in the water. This was found to be an important objection to the surface condensers. He should be glad to know whether that objection had been removed. In addition to this the steam was not generated so quickly. It was proposed at one time to use oil not composed of acids and a base, such as mineral oil, which, it had been thought, would not be decomposed by the action of the water, but he had no means of knowing whether this succeeded or not.

Mr. John Grantham remarked that the double screw system had entered somewhat largely into this discussion. It was a subject of great interest at the present time, and the naval officers who had addressed them had spoken encouragingly of its advantages. There were to this question, as to all others, two sides. The system seemed to be a very captivating one, but he thought its advantages had been somewhat overrated, and they must be cautious not to take up too readily the few examples, which had been presented under perhaps the most favourable circumstances that could be obtained, and to suppose that the system therefore had all the merits which those particular vessels were shown to possess. The builders of those ships understood their business well, and built fast vessels to which they applied the twin screws, and we did not always weigh carefully how the great success had been produced, and whether the same results, or nearly the same, might not have been produced by the single screw. It was, therefore, not unnatural that naval men, who had to do principally with ultimate results, should be very much taken by these experimental vessels, but he feared, when they had had longer experience, some of those advantages would smooth down. As yet there was no proof that two screws would propel a vessel better than one, all other things being equal. He admitted that, if they had a vessel of light draught, and put very high power into it, probably two screws would show a better result than one, from the fact that they gave a larger surface under more favourable circumstances for propelling the vessel and utilising the power given to her. But he asked the engineers and naval men present to consider all the circumstances of the case. If they wished to have a screw vessel of light draught and great power, the double screw might be best; but if they were not limited as to draught of water and did not require excessive power, the single screw would be best. One disadvantage of the twin screw system was that it made the interior of the ship more difficult to deal with than when there was only one shaft and one set of machinery. If they could apply all the power favourably to one screw, he thought it desirable to do so. It would not, however, do to dogmatise on this subject; and, whilst he would not advise them to neglect this question altogether, he would caution them against thinking the system possessed all the advantages which had been urged in its favour as having been exhibited in the very fast and well-built vessels which had been recently brought before the public.

Mr. W. Hawes confessed his surprise at the observation of one of the naval officers who had spoken, that he considered the boilers on board a great many of our ships were a disgrace to the present state of science. When they found it to be the fact that the quantity of fuel consumed had decreased from an average of 5lbs. or 6lbs. to 2½lbs. per indicated h.p., he thought it showed a great amount of progress. That result might be obtained, not simply by having the best form of boiler, and the best mode of applying the fuel, but likewise by the perfection of the machinery which was driven. The measure was the fuel required, not to evaporate a given quantity of water, but to drive an engine of a certain power. That engine would be driven with the less steam, the more perfect was the machinery; therefore, the consumption of fuel was not only a test of the efficiency of the boiler, but also of the machinery which was driven by it. Undoubtedly, he agreed that

the economical utilisation of fuel was one of the most important elements of progress in marine engines. There were two difficulties staring the engineer in the face—first, how to put the largest amount of available power on board a vessel of a given size; and, secondly, how to stow sufficient coal to make that power effective for a long voyage. In all long voyages, the period during which a vessel could run under steam was so limited that it was a matter of the greatest importance to make arrangements by which a supply of fresh fuel could be ensured at frequent stations. For his part, he believed the progress in the construction of boilers had kept pace with the improvements that had been introduced into steam machinery, and that our present boilers, so far from being a reproach to our engineers, were evidence that they had been as successfully occupied in this branch of manufacture as they had in the production of the most perfect machinery the world had ever yet seen. With respect to the twin screw system he was inclined to think if that plan had hitherto been the ordinary one for propelling vessels, and the single screw were introduced for the first time, we should be struck with the simplicity of the machinery required in the latter instance to produce the same results. In the statement of the work done by the twin screw ships, there was an omission of the speed obtained by each vessel; but in the table furnished by Messrs. Penn this information was given. The very feature by which alone we could judge of the real value of the twin system was omitted. The adoption of twin screws, it was to be remarked, involved a double risk of fouling, and if there was one difficulty more than another with regard to screw ships, it was the accidents which happened to the propellers from fouling with substances floating on the water, and certainly two small propellers were more likely to be injured in that way than one large one. Moreover, the hold of a vessel was better adapted for one pair of engines with one shaft and one screw, than for having all those parts duplicated, and consequently weaker and more liable to derangement. Although there might be advantages in this system for shallow waters and light draught, he believed where the screw was well immersed the single propeller was more effective. They could not but feel much indebted to Mr. Burgh for bringing this subject before them; whether connected with war or peace, with the navy or the merchant marine of the country, there was scarcely a question of equal importance to the nation. It was essential that we should have the best ships, the best boilers, and the best engines, to enable us to perform the longest voyages in the shortest time with the least amount of risk to the lives and cargoes conveyed.

Captain Symonds begged to state that there had been no instance recorded of the fouling of twin screws, and he believed they were far less liable to foul than the single screw.

The Chairman said, looking to the title of Mr. Burgh's paper, they must all agree that a very fair description had been given of what steam engines were in the year 1851 and of the improvements that had taken place since that time. To go into all the details of this subject would far exceed the limits of a paper; but, nevertheless, it had led to an interesting discussion, and in itself conveyed a great number of valuable details. The question of twin screws was perhaps the most important one that had been touched upon, and he agreed with Mr. Grantham that in an ordinary passenger and cargo, or mail ship, with considerable draught of water, the single screw would probably give as efficient results in speed and economy of power as the double screw; but where a great amount of power was required to be applied to a vessel of limited draught, as was the case with blockade runners, the double screw might do more than could have been done with a single one; and he would further express an opinion that in the manœuvring of ships of war in action, the double screw system no doubt conferred many advantages. He might remark that Captain Selwyn appeared to be a little mistaken with regard to the consumption of fuel. He understood Mr. Burgh to state that the consumption of coal had been reduced from 7 lbs. or 8 lbs. per indicated horse-power to as low as $2\frac{1}{2}$ lbs. Perhaps the first was rather too large a figure as applicable to ten years ago; but his own impression was that the engines of good makers had worked with a consumption of not more than $1\frac{1}{2}$ lbs. to $1\frac{3}{4}$ lbs. per indicated horse-power, which, compared with ten years ago, was a very great saving, and he thought our marine engineers ought to be gratified rather than otherwise that they had thus far succeeded in economising fuel. He now begged to propose a vote of thanks to Mr. Burgh for his interesting paper.

The vote of thanks having been passed,

Mr. Burgh acknowledged the compliment, and in reply upon the discussion, said he thought the advantages of the twin screw system were principally connected with the facilities for steering. With regard to the size of ship to which that system should be limited it was impossible to lay down any rule, because it must be borne in mind that it was more than probable that very heavy ordnance would be brought into use on ship board, so that very large vessels would become necessary, and then increased steerage power would be most valuable. The problem to be solved was whether the twin screw system admitted of universal application regardless of size and other conditions. Of that, he repeated, he required more evidence than had as yet been presented to him. With regard to the question that had been asked as to whether the accumulation of scale in the boiler had been prevented, he would say, if they used proper water in the boiler when they commenced working it, and if they took a sufficient supply of it to obviate the necessity of using dirty salt water, employing at the same time surface condensers, the scale in the boilers would be very greatly reduced. In reply to Mr. Wilson he would say, he thought the water was generally taken from the condenser, where but very little oil was presumed to be. Sometimes, it was true, in lubricating the internal portion of the cylinders, a certain portion of oil would get into the condensers, but not to an extent likely to prove injurious to the boiler.

At the conclusion of his remarks, Mr. Burgh explained the action of the equilibrium slide valve, and described the models and drawings lent by the several firms named in the paper, to whom the thanks of the Society are due.

Proceedings of Institutions.

Birmingham and Midland Institute.—The report of the Council, presented at the annual meeting, January 9th, says that although the Council are still unable to report the completion of the new buildings for the purposes of the free library and gallery of art, considerable progress has been made in their erection. They have received from Mr. Samuel Messenger a liberal offer of a pair of entrance-gates, after a design to be furnished by the Council. It is with sincere regret that the Council have to record the death, in March last, of Mr. William Oliver, who had acted as secretary of the Institute almost ever since its establishment, and who had so zealously fulfilled the duties of that office, as to earn the respect and esteem of all with whom he was brought into contact. The Council appointed as his successor, Mr. Edwin Smith, who had previously held the office of assistant secretary. Several valuable donations have been received during the past year, especially a spectroscope given by Mr. Pendleton, a former student in the industrial department. During the year thirty-two lectures have been delivered. Among these may be mentioned "Iceland and its Geysers," by the Rev. C. P. Wilbraham, Rural Dean of Newcastle; "History of Writing," by Mr. H. Noel Humphreys; "The Chemistry of Explosive Compounds," by Alfred Hill, Esq., M.D.; "The Grave and Gay in

Art, as exemplified in the Works of W. Blake, the Visionary, and George Cruikshank, the Humourist," by Sebastian Evans, Esq., M.A.; "The History of Gothic Window Tracery in England," by the Rev. T. N. Hutchinson, M.A., F.C.S.; "The Aymara Indians of Peru and Bolivia," by David Forbes, Esq., F.R.S.; "The Three Centenaries of Shakspeare," by Mr. Samuel Timmins; "Thackeray and his Works," by George Dawson, Esq.; "English Art in the days of Shakspeare," by Professor Chamberlain; "The Classification, Geographical Distribution, and Geological Relations of the Class Mammalia," four lectures by Professor Owen; "The Life, Character, and Oratory of Burke," and "The Life and Times of Washington," by C. J. Plumptre, Esq., Lecturer on Elocution at Oxford; "English Literature. The Anglo-Saxon Period," by the Rev. Alexander J. D. D'Orsey, B.D. The Council have been anxious to render this part of the operations of the Institute as interesting and attractive as possible. The attendance shows a progressive increase. The bequest by the late Sir Francis Scott of his valuable collection of Limoges enamels was mentioned in the last report. The pecuniary legacy which accompanied the bequest has enabled the Council to provide a fitting case for them, and they have been placed in the museum. The Council record with great gratitude the generosity of Lady Scott, who took upon herself the entire burden of the legacy duty on the bequest, so that the enamels passed to the Institute as a free gift. The Council also express their obligation to Professor Chamberlain for his very elegant and appropriate design for the case. It is a subject of regret to the Council that the very limited space at their disposal for the museum prevents the taking of any active steps for making any considerable additions to the collection. It is, no doubt, to the want of novelty arising from this cause that it is to be attributed a falling off in the number of visitors during the year. They have numbered only 1,229, as against 1,617 in 1863. The specification library has, during the past year, been more consulted than in any previous one. It has been visited by 705 persons in 1864, as against 626 in 1863, and 578 in 1862. In all probability, before the preparation of the next annual report, this valuable collection of books will be transferred to the walls of the free library. In the industrial department, the classes have been carried on with increased vigour and success. The aggregate number of students attending the classes by virtue of quarterly payments, has been, during the past year, as follows:—Winter term, 410; spring term, 377; autumn term, 530. These numbers do not include the classes to which the admission is by payment of one penny at the doors. These last-mentioned classes (which are chiefly composed of artisans) have largely increased. During the autumn term of 1864 the average attendance at the elementary arithmetic class has been 132; at the penny lectures, 100; at the elementary singing class, 118; making a total weekly average of 350. If this be added to the number of quarterly students it gives a total of nearly 900 persons receiving weekly instruction in connection with this department. Very marked success has attended the instruction, as tested by the public examinations, both by the Department of Science and Art and by the Society of Arts, a larger number of Institute students having entered the lists than in any previous year, and, while on the one hand the general average of success has been far higher than on any previous occasion, the number of failures has been less. An inaugural address was delivered by the Right Hon. C. B. Adderley, M.P., the president, at the opening of the session. It was stated in the last report that the sum of £81 3s. 2d. was required to free the Institute from debt. This has been paid through the generosity of William Scholefield, Esq., M.P., the president of the year, who kindly sent a cheque for that amount. The industrial department has been more nearly self-supporting than for several years past. The deficiency in that department amounts to £82 17s. 7d. In the general department there has been an excess of income over expenditure of £147 18s. 3d. The reports of the teachers in the various classes are most favourable.

DUBLIN INTERNATIONAL EXHIBITION.

His Royal Highness the Prince of Wales has announced his intention of opening the Exhibition on the 9th May.

The different foreign advices already received by the Executive Committee show that much progress is making to obtain interesting exhibits. In Canada, on the recommendation of Lord Monck, the Legislature has voted £1,000 for forming a small collection of articles. It is to include ores of copper and other metals; specimens of gold, slates, soapstone, chrome, iron, and serpentine marbles; samples of grains, hops, flax, maple sugar, and honey; sets of woods prepared for study or cabinet collections most useful in the arts, cabinet manufactures, &c.; articles of woollen manufacture, yarn and cloth, prepared skins and saddlery, implements, models, sets of newspapers and periodicals. A committee has been also formed in Sherbrooke, for forwarding a collection from the eastern townships of the province, on which Professor Miles, Lord Aylmer, Dr. Gilbert, and about a dozen other influential gentlemen, are acting.

The list of products sent on from Mauritius has come to hand, and includes specimens of the finest samples of sugar, for which the colony is famous, vanilla, a fine collection of fibres, woods, starches and grains, cigars and tobacco, matting, &c.

From Sierra Leone there will be fine collections of native products from different parts of Western Africa and the far interior, specimens of woods, the different kinds of trade beads in use, native jewellery, and other interesting articles which have been collected and shown at an industrial exhibition held in the island in February.

DIFFUSION OF ART AMONG THE MILLION.

The following recently appeared in the *Daily Telegraph*:—

When Wardour-street curiosity-shops advertise "articles of *vertu*," and critics glibly chatter about *art*, it is doubtful whether they know the solemn truth contained in the Franco-Latin and Anglo-Greek words which they employ. The Greek called the perfection of any result of human activity—the complete fitness of the means and manner to the end—its *aretè*, and the Latins imitated and adopted the idea in the word *virtus*; both expressions conveying the same meaning of "manhood," "maximum excellence," "absolute finish." Both words were intended to signify that true Art should be like to that Nature which it copies; as perfect in material, design, execution, and use as the workmanship of the Power whom these old races loved to call the "master workman." Providence "scamps" nothing, leaves nothing half-finished, nowhere shows a careless design, or a lost chance for service or beauty; the pearl of the poorest oyster-shell is as lustrously spread upon it as the silken light upon the lily-leaf. Infinite upwards and infinite downwards; passing beyond our telescopes and evading our strongest microscopes; eternal in range both ways, creation is always the same in perfection of design and admirable adaptation. There is a "common object" of the microscopist, for instance—the dust from the sea-bottom at Barbadoes. Examine it with the glass, and you are at once in a fairy ivory-turner's shop, gazing at millions of shells, every one as perfect for its inhabitant as the great conches that roll up upon the African beach. Trunk of elephant or lancet of mosquito, each is perfect in its way, each for its uses. Art, human art, has to imitate at a distance this Divine accuracy and adaptation, which give good work and true to everything they deal with. And human art can do it so far as it carries conscience, knowledge, and effort into its toil. We may take as the simplest possible example

of "art"—of "vertu"—of excellence resulting from the humblest material and means—the water-pots of clay common to the East. They must carry much, with a narrow mouth; the handles must be sunk in the outline, to avoid accident; the price must be low, the substance strong; these are the conditions; and merely by complying with them in the *best possible* way, there has resulted a graceful traditional shape, which artists delight to import into their canvases, and cannot improve upon. Beauty has been silently and surely born out of the union of an earnest mind and a true hand, though the offspring is only a pipkin or jar. "Nothing common or unclean" should thus be the maxim of Art, as it is of the deepest philosophy. Everything has its "best"—its *vertu;* and everything is worth making of the best, and in the best manner, that is worth making at all.

These are platitudes! Unquestionably; but they are platitudes which were neglected almost universally among us within the memory of middle-aged men. "Art," to so recent a date as 1851, was with the million, and with a good many who looked down upon the million from the sublime heights of the "upper ten thousand," quite a different thing from the ideal to which we have referred. "Art" was merely painting a picture, chipping a statue, modelling a teapot, carving a table, casting a figure, weaving a carpet; and it hardly struck the general public of these realms that the teapot, table, and carpet had each a *virtue* of form, construction, and colour, to miss which was to miss much or all. In Science we have always been pre-eminent; no nation has a roll more glorious than that from which a hasty enumeration can at once recall such names as Newton, Priestley, Cavendish, Smeaton, Arkwright, Watt, and Davy. But the real Art-education of the country did not begin till 1851. It is not that we wanted the faculty, as events have shown; the appreciation of good work was always to be found among us. But we wanted the impulse, and it came at last, in the year when the productions of the world were grouped in the great Glass Palace. England saw then that she had neglected, ignored, misunderstood Art—the Art, we mean especially, which, so well comprehended and studied by the French, stoops to the utensils of the cottage and to the uses of daily household life. The good Prince who bore so valuable a share in promoting the first Exhibition lent his influence to its corollary, the establishment of Art-education in England. Schools of Art were founded in the country under the direction of the Committee of Council on Education; a national museum, for examples of just and perfect workmanship, was created at South Kensington. We "began at the beginning" with an effort to reform our "pots and pans," by classes and prizes for drawing and design; and amid a good deal of inevitable merriment at the first crude proceedings of "the Brompton boilers," the community set steadily to its task, with the help of the Government, to learn how its wealth of material and solidity of workmanship could be made richer and better by beauty of colour, form, and fashion.

An important minute, just issued to Parliament by the Lords of her Majesty's Privy Council on Education, communicates the welcome fact that the idea now "runs alone." The laughers and jokers swore it was rickety from its birth; that the grants and encouragements which were administered to it were so much wasted pap; that it wouldn't and couldn't thrive; and that common things were good enough to eat and drink, and live with, especially for common people. But now Art-education has taken such a lease of life in the country that its foster-parents find they can let it shift for itself. A select committee of the House of Commons, after examining the subject, has recommended that the Schools of Art should now rely on their own resources; and the directing department of the Privy Council accepts and adopts the view. To prove how the study has flourished a very few figures will suffice. In 1851 the Parliamentary grant to Schools of Art was £6,850, for seventeen schools and 2,482 students, showing an average cost of £2 8s. per student; while in 1863 the amount of subsidy was but £4,005, the schools being ninety and the students 16,180—in other words, each pupil "of the beautiful" stands us now only in the sum of four shillings and tenpence. The explanation is that manufacturers of every kind soon awoke to the existence of a native faculty for design, and that taste was an article no longer dispensed with or imported. Left to themselves, indeed, "my Lords" observe that they would not have withdrawn the grants just yet, and they object to curtail the indirect assistance which they extend to Art-education by the National Art School, or in prizes, studentships, and payments "by results." But the select committee is quite at its ease about the local schools, and they at least are henceforward to "run alone." The Council will still pay a grant for the night-classes of artisans, and also a capitation grant for children learning drawing; and we may remark that the grounds upon which they dissent from the proposal of the select committee to extend grants for adults seem sound. The child has to be brought to the study—the artisan must bring himself; and he will bring himself just in proportion as he sees it to his own benefit, and worth paying for from his own pocket. By the subsidy for children's drawing classes elementary instruction with pencil, pen, and crayon is put upon a distinct basis, and Parliament will be asked for a special vote for this useful purpose. The changes proposed do not affect the Kensington Museum, which will remain the central depository of Art examples, and which the Council very justly defends from extravagance, by showing that its treasures are natural possessions as well as educational machinery. We need not point out the satisfactory proofs of what Art-education, now firmly grounded, has done in the country; and what it will do would be difficult to exaggerate. It has removed true taste out of the connoisseur's cabinet into the poor man's reach, whence it will come back again throught all grades of society, for be it remembered that the poor man is the working man.

Fine Arts.

The Collegiate School of Strasbourg, in virtue of a bequest by M. Lamey, formerly Judge of the Civil Tribunal of that town, offers a prize of 3,000frs. for the best essay on the following theme:—"Should art be submitted to rules? On what do they rest? Are they absolute or relative, or partly one and partly the other? How is their authority to be reconciled with freedom of inspiration?" The prize is open to all the world, and the essays, which may be written in French, German, or Latin, are to be sent in by the 1st of January, 1867.

Industrial Art Education in Paris.—The *Union Centrale des Beaux Arts appliqués à l'Industrie,* lately established in Paris, has just commenced its first course of lectures. The session was opened with an address by the President, and a short lecture on Archæology by M. Adrien de Longpérier, of the Institut. The following is the list of the remainder of the course:—Four lectures on Architecture and Artistic Industry, by M. Daviond; three on Glass Painting, by M. Ferdinand de Lasteyrie; one on the Sanitary Condition of Industrial Artists, by Doctor Caffe; three on the Grammar of the Arts of Design, by M. Charles Blanc; two on Sculpture, by M. Aimé Millet; one on Light and Shadow, by M. Fouché; and three on Ceramic Works and their Ornamentation, by M. Albert Jacquemart. This Society, already referred to in these columns, has made arrangements for a grand exhibition of objects of artistic industry in the Palais de l'Industrie this year, and offered the sum of 300 francs, in two prizes, for models or designs for the medals to be given on the occasion. The effect was far greater than any one could possibly have anticipated No less than a hundred and forty-three designs and twenty-three wax models were sent in by seventy-nine candidates, and the society, sur-

prised by the excellence of the works, doubled its grant, and gave two prizes in each class.

Public Monuments in France.—The labour, talent, and expense bestowed on the public establishments and monuments of the country have been enormous. Extensive restorations and decorations have been executed in the two great edifices of Notre Dame and Saint Denis, as well as in more than twenty churches in various parts of the Empire. The ancient Cité de Carcassonne, the Roman theatre and amphitheatre of Arles, the Château de Falaise in Calvados, the Temple of Diana, and the Roman Amphitheatre of Nimes, the Temple of Augustus and Livy at Vienne, the Abbey of Charlieu, in the department of the Loire, the Oratory of the Templars at Metz, the Chateau of Pierrefonds, the Château of Blois, the ramparts of Avignon, and other monuments of historic interest have been repaired. Of the public establishments, directly or indirectly connected with art, the building where the archives of the Empire are kept has been largely extended, and the School of Archæology annexed thereto has had a special building provided for it. The restoration of the Palace of the Institute has been completed; the arrangements of the new School of Fine Arts terminated; the old Château of St. Germain has been almost entirely restored, with the view of converting it into a grand museum of Gallo-Roman productions; the arrangements of the interior of the new Louvre have been pushed forward: a fine new gallery has been prepared for the works of the French School and thrown open to the public, a number of new rooms on both floors added to the gallery space in the new portion of the building, and several of the old rooms have been re-embellished and arranged at considerable cost; the corner building of the Tuileries by the river, known as the Pavillon de Flore, as well as a section of the grand picture gallery adjoining, have been completed as far as the masonry is concerned, and the whole of the remaining portion of the gallery has been levelled with the ground, and is now being rebuilt in the style of the adjoining work of Henry IV.; the reconstruction of the Bibliothèque Imperiale has been energetically pursued, and the new reading-room, modelled somewhat after that of the British Museum, is covered in, and will soon be ready for occupation; the famous manufactory of Sèvres has been entirely rebuilt; and the new Opera House has been carried up from the basement to the first floor. This is a long list, perhaps the longest list of such works that was ever furnished by a single Government, but it is far from complete, although it includes all the principal works connected with art which have been supported by the budget of 1864.

Statue in Honour of Teniers. — The King of the Belgians has ordered a bronze statue in honour of David Teniers, the founder of the Royal Academy of Antwerp, to be erected in one of the places of that town. The Government contributes 18,000 francs towards the work, which has been entrusted to Mr. Ducaju, of Antioch.

Pension to Mademoiselle de Puget.—The Emperor Louis Napoleon has granted a pension of 500 francs per annum to Mdlle. Fanny de Puget, the only surviving descendant of the famous sculptor of Marseilles.

The Ecoles des Beaux Arts not only in Paris, but throughout France, have been supplied with many models and casts from the antique, and copies of the works of the great painters. A class for the study of engraving on precious stones has been opened here, under the direction of M. Farochon. Pupils are admitted between the ages of fifteen and twenty-five. For foreigners the permission of the Minister of the Fine Arts is requsite.

Manufactures.

Exhibition of Arts and Manufactures for North Eastern London.—On Thursday, the 9th inst., a meeting of employers of labour and artisans interested in the manufactures of North Eastern London was held in the board-room of the Agricultural Hall Company, for the purpose of taking into consideration a proposal from the Provisional Committee of the North London Museum for a local exhibition of arts and manufactures during the ensuing autumn. The chair was taken by W. H. Bodkin, Esq., Assistant-Judge. The proposal was unanimously adopted, and also a resolution appointing a general committee of guarantors to make arrangements for carrying the same into effect. This movement is entirely unconnected with working men's industrial exhibitions, having solely for its object the promotion of the art-workmanship and manufactures of the district. The exhibition will consist of three distinct divisions—a manufacturers' department, an artisans' department, and a loan department. The guarantee fund asked for by the promoters of the exhibition is £2,000, of which about one-third was guaranteed by the meeting, and a considerable portion of the remainder promised.

Pneumatic Application of Ammoniacal Gas. — M. C. Tellier, whose proposed application of ammoniacal gas to locomotion was recorded in the *Journal* of the Society a short time since, now suggests a more simple application of the same substance, that of using it to create a vacuum, or partial vacuum, for industrial purposes, such for instance as the emptying of cesspools. The method proposed to be employed is to fill an iron receiver with the gas in question, and convey it to the spot where the vacuum is required. At the upper part of the receiver is a small reservoir containing water, and which communicates with the interior of the receiver by means of a stop-cock; when this is opened the water rapidly absorbs the gas, and the required vacuum is obtained. The quantity of water necessary for this purpose is said to be in the proportion of six or seven litres to a cubic metre of gas. In order not to lose the ammonia this is allowed to escape into another similar reservoir at the lower end of the receiver before the connection is opened between the interior of the latter and the cesspool. With this arrangement the total cost, in addition to that of the apparatus and the original supply of ammonia, would, according to M. Tellier, be reduced to the value of the coal required to disengage the gas from the solution, and this he estimates at four or five centimes the cubic metre. M. Tellier contemplates many applications of this principle, but the above will sufficiently illustrate his views.

Transformation of Napthaline into Benzoic Acid. —Two French chemists, brothers, announce the following method of transforming the residuum napthaline into benzoic acid. In the first place the napthaline is transformed into thallic acid, and afterwards into thallate of lime, and the latter is converted by heat into benzoic acid and carbonate of lime. The acid derived from napthaline has the same unpleasant odour as that obtained from the urine of herbiverous animals, and it is conjectured therefore that the agreeable odour of the same substance when derived from the gum is not normal but due to the presence of some foreign substance.

Liquid Glue.—The use of this substance has become very extensive in France, and it may be useful to give the process by which it is obtained. A kilogramme, $2\frac{1}{5}$lbs. avoidupois, of good glue of Cologne, or Givet, is dissolved in a litre of water in an earthen pot plunged in hot water, the water lost by evaporation being replaced. When the glue is completely dissolved, one fifth of a kilogramme of nitric acid at 30° centigrade is added; the acid throws the solution into a violent state of effervescence, and a quantity of reddish coloured gas escapes. When the mixture has become quiescent it should be well stirred, set aside to cool, and afterwards placed in well stopped vessels for future use.

Metallic Ceiling.—While all other departments in the internal decoration of houses have kept pace with improvements in other branches of industry, it is a somewhat remarkable fact, and one that has long engaged the

attention of architects, that the ceilings of our rooms, with their unseemly blisters and network of cracks, are still, generally speaking, just what they were many years ago. Mr. Little has invented a system for the construction of ceilings, which consists in the application to the joisting of very thin stamped ductile metal, in ornamental embossed panels of such sizes and shapes as may be required, These stamped panels are fitted for every kind of decoration in colour, and if inserted as plain surfaces, may be used as the ground for every description of cartoon painting, combining with lightness and durability artistic and ornamental effect at a comparatively small cost. Besides its applicability to the ceilings of rooms, and all public buildings, churches, &c., the system may be made use of with the same effect in staircases, halls, and porticos, and even on the walls of rooms. It affords the means, when coupled with an iron framing, of making theatres fireproof, thus avoiding those sad contingencies to which these crowded buildings are so exposed.

Commerce.

SPIRITS AND WINE CONSUMPTION.—The average consumption of spirits, per head of the population, is shown by the following figures, for the last 60 years :—

	GREAT BRITAIN.		IRELAND.	
	Foreign and Colonial.	Home-made.	Foreign and Colonial.	Home-made.
	Gallons.	Gallons.	Gallons.	Gallons.
1800	0·31	0·531	0·09	0·257
1820	0·24	0·440	0·05	0·490
1840	0·22	0·787	0·04	0·907
1860	0·21	0·724	0·03	0·808

The wine consumption shows a gradual decline, which is not compensated by any very apparent increase in malt:—

	GREAT BRITAIN.	IRELAND.
	Gallons.	Gallons.
1800	0·46	0·28
1820	0·33	0·07
1840	0·34	0·09
1860	0·27	0·09

COTTON IN SIAM.—The *London and China Telegraph* says that special efforts have been made to increase the supply of cotton for the coming season. The profits to the cultivators on this important staple for the past two years have stimulated the people to give it greater attention, but with every possible effort it is not probable the increase can add more than one-fifth to the last crop. The cultivators are too few to expect more than that. According to the custom-house returns, 17,710 piculs have been exported during the year from Bangkok up to the 14th November, amounting to 2,334,339 lbs., and worth, at a moderate estimate, say 500,000 dols. The season (in mercantile language) is now over, but it is possible that the whole export for the year may reach 18,000 piculs.

BEET ROOT SUGAR IN FRANCE.—The beetroot sugar manufactured in France in September last amounted to 2,755,400 kilogrammes, in October to 38,847,910, in November to 44,832,875, in December to 35,476 845, and in January to 13.474,652, making for the five months 135,387,682 kilogrammes. Of this the sugar manufactories in the department of the North produced 50,618,237 kilogrammes, in the Pas de Calais 23,467,933 kilogrammes, in the Aisne 21,860,699, in the Somme 13,152,597, in the Oise 10,628,696, and in other departments 15,659,550 kilogrammes. There remained, moreover, in store of the preceding year's produce 13,828,243 kilogrammes. The consumption of beetroot sugar during the same five months amounted to 189,160,903 kilogrammes. The stock of beetroot sugar on the 31st of January last amounted to 87,470,079 kilogrammes, being 18,753,787 kilogrammes more than on the corresponding date of the year 1864. The number of sugar manufactories at present at work is 398, being 34 more than at this time last year. These returns are regarded as indicating that the beetroot sugar manufacture in France is prosperous.

THE VINE IN ALGERIA.—This cultivation has made great progress within these last few years. In the year 1862, the land planted with vines was estimated at 16,000 acres, of which 8,000 are situated in the provinces of Algiers, 5,500 in the province of Oran, and 1,500 in the province of Constantine. The vineyards produced in that year 43,222 hectolitres of wine, and 18,472,912lbs. of grapes were sold for the table. The land was chiefly planted with the Chasselas-Burgundy, Alicante, and Grenache vines. In 1863 additional plantations were made, both by the Arabs and colonists. The number of planters amounted to 27,281, of whom 22,300 were natives, and 5,000 Europeans. The vineyards covered 87,000 acres, of which 50,008 were planted with vines producing black, and the remainder with those producing white grapes. Of these vineyards, 10,500 acres are situated in the province of Algeria, which produced 83,000 hectolitres of wine, and 8,500,000lbs. weight of grapes for sale; 64,000 acres in the province of Constantine, producing 30,000 hectolitres of wine, and 4,100,000lbs. of grapes; and 12,500 acres in the province of Oran, producing 20,000 hectolitres of wine, and 2,000,000lbs. of grapes. The vines in the province of Constantine are newly planted, and do not as yet produce much wine.

EGGS.—From a recent Parliamentary return it appears that the annual importation of eggs into this country is at the rate of near one million daily.

COTTON SUPPLY.—The largest amount of cotton brought into this country for consumption was in 1860, when it amounted to 2,650,000 bales of 400 lbs. each. The total imports in Liverpool in 1864 were 2,247,755 bales, of which rather more than one-half were from India.

Colonies.

NATAL.—Of late years the coast lands of this dependency have been steadily opened up for the cultivation of sugar cane, coffee, tobacco, and other tropical products. The county of Victoria is separated from the seaport of Durban by the river Umgeni, which, although shallow enough during the dry winter months, is in the summer so deep and dangerous that it has been a formidable obstacle to traffic. While production and traffic were alike small the inconvenience entailed by such a troublesome stream was not felt to any material extent. In ten years, however, a great change has come over the country. There are now thirty sugar mills driven by steam at work in the colony. Last year about 4,000 tons of sugar were produced. Coffee and other plantations are springing up in all directions, and the Cotton Plantation Company has nearly 1,000 acres under cultivation. Hence has arisen the necessity for a bridge over the Umgeni, and the Queen's-bridge, which was recently opened, is an iron girder bridge, erected on cylinders, which rest on a bed of creosoted timber piling. There are seven spans, of about 100 feet wide each, and the bridge with its approaches is altogether about 1,100 feet long. The roadway is 20 feet wide and paved with asphalte. No other bridge in South Africa can at all vie with this either in size or appearance, and it is creditable to the young colony that it should have been accomplished, at a cost to itself of about £17,000, what the older provinces of the Cape have not yet contemplated.

North Australia.—An Australian paper says:—"If a colony could be established by Government *employés*, there would be no doubt as to the success of North Australia. It appears that many hundreds of young men, belonging chiefly to the middle class of this community, are quite ready to colonise the new country for the remuneration of five shillings per day. For this pay they are willing to bind themselves as labourers to do the rough work of the settlement in spite of aboriginal Malays, alligators, and tropical summers. This shows that the love of adventure is as strong here as in other parts of the world. Whilst, however, the two Government expeditions which have sailed are absolutely necessary to the establishment of the young colony, it must be borne in mind by the hundreds of persons who are looking with interest to North Australia, that the success of the enterprise must, after all, depend upon the efforts of individuals who go to occupy the country upon their own responsibility. A large extent of land has been sold, and it is fair to suppose that at least some of the purchasers will either become settlers themselves or will cause their property to be occupied by others. It is not to be expected that South Australia should supply the new country with any large number of settlers in addition to those who go there in the pay of the Government. In fact, the bulk of a population like ours would be as much out of place in North Australia as in India. Our labourers would be unsuited to the wet tropical summers of such a country, and would be unable to compete with the coolies and the Chinese who will come in thousands as soon as there are planters and other settlers ready to make arrangements for their immigration. But there is a way in which this colony could materially assist the new colony, that is, by persevering in the attempt to send stock overland. If this were successfully done, North Australia would almost immediately secure an export trade with Madras, Calcutta, Java, and Mauritius. The two last-mentioned countries are always ready to import horned cattle, whilst the Indian markets at the present time have to be supplied with horses from New South Wales and South Australia. The passage from North Australia to Madras or Calcutta would occupy about four weeks, and it is said that the vesssls best suited to the trade would be those of about 300 or 350 tons burthen. September would be the proper time to ship horses for India, as they would then arrive there at the commencement of the cool season."

Barbadoes.—The shipments of produce last year were 36,108 hhds. sugar and 16,000 puns. molasses, against 42,000 hhds. sugar and 15,000 puns. molasses of the previous year. The cotton speculators also have cause to be satisfied, as their harvest, it is calculated, will realise 300,000 dols. return to the proprietors; and, what is more consoling again, this sum will be sure to be circulated in the island, the cotton being grown on small properties and sold on the spot. Here is no little advantage to reap from about 2,000 acres of land which hitherto were almost waste, giving little or no return. The sugar crop, this year, it is anticipated by some (of course the most sanguine) will reach 50,000 hhds. A steam plough has been successfully used on one estate, and the canes grown on this land are said to be of so superior a quality as to yield some three hogsheads to the acre.

British Guiana.—The quantities of produce shipped from the whole colony during the past year are as follows:—Sugar, 73,312 hhds.; rum, 26,053 puns.; molasses, 12,632 casks; timber, 816,812 feet; and cotton, 239 bales. The quantities shipped in 1863 were 77,105 hhds. sugar, 30,252 puns. rum, 5,704 casks of molasses, 408,769 feet timber, and 52 bales of cotton. There is an apparent falling off in the yield of sugar and rum as compared with the previous year's returns, but it is only apparent. The crop of last year largely exceeds that of the previous year, but from the want of shipping there is a large quantity of produce lying on hand; in fact, a larger quantity than has been found on hand at the same period in any previous year, and it will have to be brought into the current year's exports.

Public Works in New South Wales.—The opening of a branch railway from Blacktown to Windsor and Richmond, which took place on the 29th November last, was an event of much importance, not only on account of the benefit it has conferred upon a populous and fertile district, but also in relation to the question of railway communication in the colony. In order to lessen the cost of this railway, the works are much lighter in their character than those on the trunk lines. Should the new railway realise the expectations that have been indulged in, as to the suitability of the works to the nature of the traffic, the experience gained may be of value in the construction of future lines.—At Newcastle, progress is being made with the various works for the improvement of the harbour. The northern breakwater is being proceeded with; upwards of 1,200 tons of stone were deposited in November last. The ballast is supplied by vessels coaling at the port. Preparations are being made for the repair of the southern breakwater, which was damaged by gales. Along the greater portion of the new wharf the water has been deepened, and vessels drawing seventeen or eighteen feet of water can now go alongside. The steamers' wharf is completed, and plans are being prepared for a commodious goods shed to be erected close to it.

Salmon and Trout in Tasmania.—A favourable account has been received of the progress of both the salmon and trout in Tasmania, and Badger Creek, the locality chosen, appears admirably adapted for the salmon. The fish at present there are in good health and growing fast. The advisability of constructing a regular fish-hatching establishment at the place has been dismissed.

Publications Issued.

Le Monde de la Mer. By "Alfred Frédol." Royal 8vo. Paris (*Hachette*).

Le Ciel. By Amedée Guillémin, and

Les Plantes. By Louis Figuier (same form and same publishers).

Le Monde des Insectes. By S. Henri Berthoud. Royal 8vo. Paris (*Garnier, Freres*).

These represent a class of work which has only lately sprung up in France—popular expositions of scientific subjects, profusely illustrated. The most remarkable of the four whose titles are given above, is that which stands at the head. It is not signed by its author, but was the work of the late Moquin Tandon, of the Institut, a naturalist whose name would have stamped it with authority, but being written in a popular style, and not in scientific form, the academican used the pseudonym which he had often affixed to poetry and other miscellaneous works. He died while the sheets were going through the press. The work in question occupies more than six hundred pages, and all the products of the sea and its banks, from seaweed to white bears, are treated of in turn, and in a very interesting manner—scientific facts being intermingled with amusing anecdotes and remarks, and sometimes, it must be admitted, not quite according to English notions. The illustrations consist of twenty-one full-sized chromo-lithographic plates, and two hundred illustrative cuts, of all sizes, on wood—all from the pencil of M. P. Lackerbauer. These latter are executed with great care and distinctness, and the peculiarities of the sea anemones and of the microscopic creatures of the ocean are given with rare fidelity; but the twenty-one coloured plates are really exquisite. M. Moquin Tandon's last work may not increase his high scientific reputation, but it will assuredly make his name known to thousands who never heard of it before, and would not otherwise have easily become acquainted with the wondrous creatures which he so lovingly and so agreeably describes.

The second book on the list is also a popular production by a highly scientific man, and, so far as the subject admits of it, it is illustrated with the same careful and profuse elegance. Like the preceding, the subject is treated with as great avoidance of technicalities as possible. Both these gentlemen acknowledge the assistance of their brother savans in various countries, and it is gratifying to see the names of Herschel, Gosse, and other Englishmen in the list. The other two treatises are by gentlemen well known as popularizers of science and pleasing writers, and they have performed their work in a very conscientious and agreeable manner. It would not be easy to find four other books in which knowledge is conveyed in a more pleasing style, or four volumes presenting higher qualities as regards typography and illustration.

Notes.

Southern Counties Association for the Encouragement of Agriculture, Arts, Science, Manufactures, and Commerce.—The second monthly meeting of the Council of the Association was held on the 7th inst., at the house of the Society of Arts. Present—the Marquis Camden (in the chair), Lord Viscount Sydney, Lord Viscount Eversley, Sir Henry Mildmay, Bart., G. Cubitt, Esq., M.P., G. Lyall, Esq., M.P., Lieut.-Col. Lennard, C. Wykeham Martin, Esq., Hon. and Rev. S. Best, Rev. J. Clutterbuck, and Messrs. Clutten, Spiers, Rigden, Whitehead, Simonds, Middleton, and Newton. After the transaction of the general business of the Council, the offer of the services of G. W. H. Shute, Esq., of Yateley, as secretary, were accepted. Sir W. Brook Bridges, Bart., M.P., and Major-Gen. the Hon. A. Hood were elected vice-presidents; and Wm. Deedes, Esq., of Sandling Castle, Wm. Wells, Esq., of Redleaf, Penshurst, and the Rev. John Goring, and P. S. Punnett, Esq., of Chart Sutton, added to the Council. A code of bye-laws was referred to a sub-committee, consisting of Lord Viscount Eversley, Colonel Lennard, Mr. Lyall, and Mr. Rigden, to report to the next meeting of the Council. After much consideration it was resolved that it would be impossible, before June, 1865, to make the necessary arrangements for the great annual exhibition of stock and implements proposed by the Association, but that the meetings for the second, third, fourth, and fifth departments of the Association—viz., natural history, local geology, botany, and horticulture, the second; the arts, manufactures, and commerce, as developed in these six counties, the third; local history and archæology, the fourth; and the improvement of the dwellings and the general condition of the labouring classes, the fifth—shall be held, and the times and places determined at the next Council. The Council was then adjourned to Wednesday, April 5, at two o'clock.

Renewal of Old Fruit Trees.—A French horticulturist has hit upon a curious mode of revivifying old fruit trees. He recommends that so long as the roots of the old trees are sound they should never be destroyed. His plan is, when the tree ceases to be productive, to cut it down to the neck of the roots and to insert two, three, or four grafts into the stump. This system he declares applicable to pear, apple, cherry, and almond trees. When the grafts have been put in, the face of the stump must be carefully covered with grafting wax or clay, and then the whole surrounded and covered up with mould, so that only one or two eyes of the grafts may be exposed. Six old pear trees were so treated on the 18th of March last; the grafts have attained from thirty to sixty inches in length, look very promising, and are expected to bear a good crop of fruit in three years. Where the roots of an old tree are well developed and sound, this mode of making use of them for a new family of small trees is certainly worth a trial.

Brome.—M. A. Lavallée, who has given much attention to the cultivation of the *Bromus schraderi* (referred to recently in the *Journal*), has just published a pamphlet on the subject,* giving an account of the experiences of himself and others with regard to this plant, its mode of cultivation, yield, influence in the production of milk, and chemical analysis. The main facts given are as follows:—The plant will yield two crops a year at first, and, in some cases, after the first year, three crops. A sandy soil seems best adapted for producing the grain of the plant; on damp land the seed is less abundant, small, and lighter. The yield, in some instances given, was as 74 to 1. The grain is exceedingly light, weighing little more than about two pounds to the gallon, or about half the weight of oats. After the sowing the ground is said to require no care whatever but simple rolling in spring. The soil should be turned up to a good depth previous to and heavily rolled after sowing; the latter point being much insisted on. If sown in March or April the first green crop may be cut in two months. The brome kills all the weeds that spring up with it. It is said to be the thickest-growing and cleanest crop known. The duration of the plant cannot yet be fixed, some in France are five years old, and are said to give no sign of failure, although five crops a year have been taken off it.

Climate of England.—At the Meteorological Society, Mr. Glaisher recently read a paper, in which he stated that the results of recorded observation showed that the character of the climate at the end of the last century was certainly very different from what it is now. Long continuance of frosts, and frequent and heavy falls of snow, are facts which can be recorded without instruments as well as with them. In the early period they were of more frequent occurrence than in the middle period of 30 years, and far more so than in the latest period. Thus the result, as formed by this comparison, without reference to instruments, and every investigation made all tend to confirm the accuracy of the indication found by instruments, viz., that our climate in the last hundred years has altered; that the temperature of the year is 2° warmer now than it was then; that in the month of January it is still higher; that the winter months are all much warmer; and that every month in the year seems to be somewhat warmer than before. The author remarked that this result was indeed important, if true, and he could not see how it was otherwise than true. Its effects will be to influence agricultural produce. New fruits may be introduced with advantage, and the character of our people will be altered.

Education in Russia.—The Russian government, as a consequence of the emancipation of the peasants, has taken measures for the diffusion of instruction among the agricultural population. An additional budget of 450,000 roubles for the year 1865 has been decreed, so that the budget of Public Instruction now amounts to about 1,300,000 roubles. This supplementary budget provides for the founding of village schools, of eleven new gymnasia (colleges), for the purchase of books, paper, &c., for the poorer peasants, for supplementary payment to schoolmasters and professors, for the purchase of scientific instruments, for the establishment of laboratories and museums, for the reorganisation of the University of Warsaw, for the foundation of a Polytechnic School, and for other schools for teaching agriculture and horticulture.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...British Architects, 8.
Medical, 8.
Asiatic, 8.
Society of Engineers, 7. Discussion on Mr. Kock's paper "On Strength and Rigidity."
R. United Service Inst., 8½. 1. Commander F. P. Warren, R.N., "The Compositions for the Protection of Iron Ships' Bottoms from Fouling and Rust." 2. Mr. F. N. Gisborne, C.E., "His Anti-Fouling Composition for Iron Ships' Bottoms."

* J. Rothschild, Paris.

TUES. ...Civil Engineers, 8. Discussion upon "Drainage of Paris" and "Metropolitan System of Drainage."
Statistical, 8. Professor Rogers, "On the Statistical and Fiscal Definition of the Word 'Income.'"
Pathological, 8.
Ethnological, 8. 1. Mr. Clements R. Markham, "On the Arctic Highlanders." 2. Dr. Rae, "On the Esquimaux."
Royal Inst., 3. Prof. Masson, "On Recent British Philosophy."

WED. ...Society of Arts, 8. Mr. G. C. Steet, "On the Preservation of Food, especially Fresh Meat and Fish, and the best form for Import and for Provisioning Armies, Ships, and Expeditions."
Geological, 8.
London Inst., 7.
R. Society of Literature, 4½.
Archæological Assoc., 8½.

THURS...Royal Inst., 3. Professor Masson, "On Recent British Philosophy."
Philosophical Club, 6.
Antiquaries, 8.
Royal, 8½.

FRI.......Royal United Service Inst., 3. Mr. Benjamin Sharp, "The Comparative Merits of Smooth-bore and Rifle Ordnance when employed at Sea, and on the Proper Armament for Ships of War."
Royal Inst., 8. Professor Westmacott, "How Works of Art should be looked at."

SAT.......R. Botanic, 3¾. Prof. Marshall, "On the Nervous System.

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 28th February*, 1865.

3 (121 to 130). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 121 to 139.
26. Tewkesbury Borough Magistrates—Correspondence.
64. Navy (Shipbuilding Works)—Programme.

Session 1864.

546. Army, &c. (Clothing)—Return.
554. Local Government Act (1858)—Sixth Annual Report.

Delivered on 1st March, 1865.

22. Bill—Public House Closing Act (1864) Amendment.
3 (140 to 152). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 140 to 160.
8. Poor Relief (Scotland)—Return.
29. Battersea Charities—Report of Inspector.
67. East India (Army and Police)—Returns.
76. Bullion—Return.
Census of Ireland (1861), Part V.—General Report.

Session 1864.

568. Population and Revenue—Return.

Delivered on 2nd March, 1865.

40. Bills—Affirmations (Scotland).
43. ,, Sheep, &c. Protection, (Ireland).
3 (154 to 173). Railway and Canal, &c. Bills—Board of Tra Reports (Parts 154 to 163).
66 (II.) Railway and Canal, &c. Bills—Third Report of Gener Committee.
Life Annuities—Regulations respecting Government Insurances
Unmalted and Malted Barley—Preliminary Abstract Report o Experiments.

Delivered on 3rd March, 1865.

44. Bills—Inns of Court.
45. ,, British Kaffraria (amended).
3 (153). Railway and Canal, &c. Bills—Board of Trade Report Part 153.
3 (174 to 182). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 174 to 182.
34. Metropolitan Board of Works—Account in Abstract showing the receipt and Expenditure, &c.

Delivered on 4th and 6th March, 1865.

46. Bills—Church Attendance.
47. ,, Metropolitan Toll Bridges.
48. ,, Writs Registration, &c. (Scotland) (No. 2).
49. ,, Herring Fisheries (Scotland).
3 (183 to 206). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 183 to 206.
13. Soldiers' Trades—Return.
53. Revenue and Trade (Ireland)—Abstract.
61. Army Estimates—Statement.
65 (II.). Committee of Selection—Third Report.
69. Patriotic Fund—Fifth Report of Royal Commissioners.
72. Army and Militia (Flogging and Marking)—Returns.
81. Mary Ryan—Official Correspondence.
86. Education—Returns.
88. Malt—Return.
93. Civil Services (Scheldt Toll Redemption)—Supplementary Estimate (Class 7), Vote 12.
100. Piers and Harbours (Provisional Orders)—Board of Trade Report.
New Zealand—Further Papers.

Delivered on 7th March, 1865.

47. Bills—Metropolitan Toll Bridges (a Corrected Copy).
50. ,, Private Bill Costs (as amended by the Select Committee.)
3 (207 to 227). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 207 to 237.
57. National Debt—Account.

Patents.

From Commissioners of Patents Journal, March 10th.

GRANTS OF PROVISIONAL PROTECTION.

Aeriform fluids, motive power from—501—M. P. W. Boulton.
Beer, &c., brewing, fermenting, &c.—2719—C. Garton and T. Hill.
Bottles, jars, &c., stoppers for—27—N. Thompson.
Buoys, beacons, &c.—387—C. Atherton and A. H. Renton.
Cabinet, sofa, and chair-bedsteads—476—A. Sharp.
Caoutchouc, manufacture of—398—P. A. Le Comte de Fontaine-Moreau.
Coats and capes, waterproof—471—C. D. Barge and A. Hermant.
Dough, apparatus for working—483—J. H. Johnson.
Escapement, application to clocks of a circular—462—P. E. Bidaux.
Filtering apparatus—249—V. Burg.
Fire-arms—425—B. Thompson.
Fluids, apparatus for raising and forcing—410—J. Gresham.
Furnaces—443—E. B. Wilson.
Globes or shades—2791—M. A. F. Mennons.
Hay, cotton, &c., construction of presses for—3294—H. A. Bonneville.
Iron, machinery for rolling and hammering—375—J. Ramsbottom.
Lawn mowing machines—458—J. B. Brown.
Liquids, obtaining power from—2770—C. Garton.
Looms—494—J. Dodgeon, J. Gaukroger, and W. Shackleton.
Mashing machines—481—R. Willison.
Mineral oils, extracting gases from—344—W. Sim.
Motor, mercuro-hydraulic—492—R. A. Brooman.
Ordnance, &c., manufacture of—295—J. H. Johnson.
Puddling furnaces—473—J. G. N. Alleyne.
Reaping machines—384—D. H. Barber.
Shifting wrenches—457—W. Clark.
Ships afloat, examining, cleaning, and repairing the bottoms of—105—R. F. Moll.
Steam engines—338—C. Lungley.
Stopping bottles—464—J. J. Chidley.
Tanning leather—2704—W. Smith.
Ventilating blinds—443—C. Lungley.
Weights, use of magnets in overbalancing—461—T. P. Tregaskis.
Zinc, products obtained when coating iron with—469—J. Graham.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Crinolines, covered steel for—588—W. S. Thomson.
Clothing, covered springs for—623—T. S. Sperry.

PATENTS SEALED.

2239. B. Glover.	2331. E. R. Handcock.
2274. C. Brown.	2362. W. Clark.
2323. S. Laing.	2453. T. Brown.

From Commissioners of Patents Journal, March 14th.

PATENTS SEALED.

2260. J. H. Simpson.	2339. W. Palmer, jun.
2275. M. D. Jeffreys.	2340. J. H. Kidd & J. C. Mather.
2277. R. Chrimes.	2344. H. Bridgewater.
2280. J. Adams.	2374. J. C. Wilson.
2283. R. Richards.	2376. H. and H. Forbes.
2288. J. Smith.	2404. W. F. Henson.
2294. R. A. Brooman.	2431. G. T. Bousfield.
2295. R. W. Sievier.	2445. C. Greenway.
2298. W. Lawrence.	2548. W. E. Newton.
2305. W. Clark.	2623. W. Richards.
2309. H. Rogers.	2970. R. Maynard.
2314. J. L. Courcier.	2995. T. Harris.
2327. I. Watts, jun.	123. A. V. Newton.
2335. B. W. A. Sleigh.	152. W. E. Newton.
2338. W. B. Woodbury.	200. W. E. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

617. T. H. Wood.	723. G. Hamilton.
658. C. Hall.	929. G. and J. Collier.
893. J. P. Woodbury.	671. W. Conyers.
667. W. H. & F. C. W. Latham.	652. J. Nadal.
782. D. E. Siebe.	689. E. T. Hughes.
647. J. B. G. M. F. Piret.	810. T. White.
648. J. T. Calow.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

492. G. T. Bousfield.	532. D. Gallafent.
529. A. Wallis and C. Haslam.	

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, MARCH 24, 1865. [No. 644. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

March 29.—"On Window Horticulture, and the Cultivation of Plants and Flowers in Cities and Crowded Localities." By John Bell, Esq.

April 5.—"On food for Cattle." By Professor John Coleman.

Cantor Lectures.

The Third Course for the present Session will consist of six Lectures "On Some of the Most Important Chemical Discoveries made within the last Two Years," to be delivered by Dr. F. F. Crace Calvert, F.R.S, F.C.S. (Corresponding Member of the Royal Academy of Turin ; of the Société Industrielle de Mulhouse ; of the Société Imperiale de Pharmacie de Paris, &c.), on Tuesday evenings, at Eight o'clock, as follows :—

April 4th.—Lecture 1.—On the discoveries in Chemistry applied to Arts and Manufactures.

April 18th.—Lecture 2.—On the Discoveries in Chemistry applied to Arts and Manufactures (*continued*).

April 25th.—Lecture 3.—On the Discoveries in Agricultural Chemistry.

May 2nd.—Lecture 4.—On the Discoveries in Physiological Chemistry.

May 9th.—Lecture 5.—On the Discoveries in the Chemistry of Rocks and Minerals.

May 16th.—Lecture 6.—On the Discoveries in the Chemistry of Metals and Alloys.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture.

Institution.

The following Institution has been received into Union since the last announcement :—

Carmarthen, Literary and Scientific Institution.

Proceedings of the Society.

Sixteenth Ordinary Meeting.

Wednesday, March 22nd, 1865 ; Dr. W. A. Miller, F.R.S., Professor of Chemistry, King's College, London, in the chair.

The following candidates were proposed for election as members of the Society :—

Booth, Captain John, 21, Kensington-crescent, W., and Conservative Club, S.W.
Chatwood, Samuel, Lancashire Safe and Lock Works, Bolton.
Good, Henry, 21, Upper Hamilton-terrace, N.W.
Mackenzie, James Joseph, Jennings' Hotel, Albemarle-street, W.
Morris, William, Carmarthen.
Scully, George, 4 and 5, Agar-street, and 7, Adam-street, Strand, W.C.

The following candidates were balloted for and duly elected members of the Society :—

Newcombe, Cornelius Prout, 16, Barnsbury-villas, Liver pool-road, N.
Perkes, Samuel, West Dulwich, S.
Scott, Colonel, R.E., Ealing, W.
Tanqueray, Arthur Charles, Hendon, Middlesex, N.W.

The Paper read was—

ON THE PRESERVATION OF FOOD, ESPECIALLY FRESH MEAT AND FISH, AND THE BEST FORM FOR IMPORT AND PROVISIONING ARMIES, SHIPS, AND EXPEDITIONS.

By G. C. Steet, Esq., F.R.C.S.

The increased and increasing cost of meat in this country has recently given a fresh impulse to the important question of the preservation of food of all kinds, whether as an article of import for home use, for providing stores for the army, navy, or merchant service, or for expeditions, &c. The recent correspondence in the public journals, excited by the introduction of the South American beef as a means of meeting the deficient supply of fresh food at home, has also given a new impetus to the very important question, By what means can provisions, when and where in great plenty, be preserved against a season

of great dearth or pressing necessity? This question has frequently occupied men's minds, either as a commercial speculation or as a useful and benevolent object, and many processes have been advocated and used for this end. In the subsequent remarks I am about to make I shall confine myself almost entirely to the means used for the preservation of flesh food.

The first means, one that may well be styled the "ready method," and which has been the one longest in use, is to prevent decomposition by certain saline substances; common salt, as the most abundant and cheapest, has been most frequently used; to this has been added other salines, such as nitrate of potash and chloride of aluminium, or certain aromatics, as pepper and spices; with these have been variously combined sugar, vinegar, wood naphtha, &c., A patent was taken out in 1847 for using a preservative liquid made by neutralising strong acetic acid by sesquicarbonate of ammonia; the result is "acetate of ammonia, which is eminently volatile, and is given off in the act of cooking." This saline was, however, to be mixed with common salt. The ready method has been long applied to the preservation of fish, and a very large trade has been carried on both in import and export. An instance of the former may be given in the introduction into this country of the herrings cured by the Dutch, in which trade we could not compete with them after many attempts, and with much support to the manufacture by grants and supplies voted by Government, the Dutch excelling us by the care with which they conducted the process. An instance of export may be taken from the great quantities of pilchards which are cured and packed in casks and sent to the inhabitants of the European shores of the Mediterranean. Government formerly made grants in aid of this trade. The means for imbuing the substance to be preserved with the saline matters are various; the commonest is rubbing with dry salt, and thus introducing it by capillary attraction or endosmose, at the same time that much of the fluid constituents of the meat are abstracted. Soaking in brines, differently compounded, is another plan. This would, however, abstract from the flesh the same fluids. Other processes, which partake of a less crude but more scientific feature, are the patent of C. Payne, 1840, in which an apparatus is suggested "on the principle of the ordinary air-pump," to exhaust the air from the chambers, and, at the same time, from the structures of the meat, and the addition of a force-pump for "supplying the liquor" for salting. This is a plan similar to Kyan's method for preserving wood against decay. S. Carson's patent of 1842 mentions four methods—(*a*) injection; (*b*) exhaustion of any gases in the meat, and consequent penetration of pickling liquids by atmospheric pressure; (*c*) "causing preservative liquids to penetrate more quickly into meat or animal substances by means of pressure produced by centrifugal force;" and (*d*) the same object gained "by means of a weight of liquid in motion being suddenly checked or stopped."

A still more interesting process, and one that is evidently the most expeditious and most readily used, is that of injecting the carcase of an animal recently killed with a solution of such saline compounds as may be thought best adapted for the purpose. I allude to the plan advocated and practised so successfully by Mr. Morgan, who read a paper on the subject before this Society in April, 1864. Some plans of a similar character were, however, propounded some time before. It does not appear with what success. They are as follows:—In 1834 a patent was granted for "Injecting certain antiputrescent and flavouring preparations into the blood vessels of animals by means of a force-pump." The preparations may consist of water, salt, saltpetre, spice, and vinegar. Another, in 1851, for injecting the carcases of animals with a saline liquid containing chloride of aluminium, chloride of sodium, and nitrate of potash; it does not, however, explain that the fluid is injected by means of the blood vessels. In 1855 a method for "Preserving and curing by salting the flesh and hides of animals in an entire state by injection, by preparing a solution of saline substances, to be forced into the veins and arteries of animals within a short period after they are slaughtered, so as to render them incapable of becoming putrid." It will only be necessary to state that the preservative matters used by Mr. Morgan are salt, nitre, sugar, with spice and sauce for flavour, a small quantity of mono-phosphoric acid being added to coagulate the albumen contained in the fluids of the flesh; and that these substances are injected in solution by gravitation through the main artery of the body, and thus to all its minutest ramifications, returning by the veins to the right side of the heart; it must be manifest that by this means every part and every structure of the body must be completely permeated by the solution, and therefore thoroughly and effectively influenced by the antiseptic properties of the substances injected. This plan for curing meat was adopted by the Admiralty for experimental purposes. Animals were salted, cut up, several joints dried, and sent abroad in ships, to ascertain by the tests of time, climate, packing, &c., what effects would be produced on them.

Mr. Morgan's method has been objected to on the ground that it is a most effectual means of abstracting from the flesh its nutritious qualities, and to a much greater extent than by the ordinary plan of salting by rubbing with dry salt. I applied to Mr. Morgan for the results of the experiments above mentioned, and have been informed that he has received two consignments of meat from South America in small quantities as samples, but not enough to be introduced for sale. He has had notice from the Admiralty that the meats prepared last January twelvemonth and sent abroad were all sound and right; the dried meat, manufactured at the same time, was reported on by a Commission of the Channel Fleet this autumn, and pronounced good and agreeable. He has also heard from the French Government that the meats, beef and mutton, prepared in July and August, 1864, when examined in January, 1865, were found perfect. The features of his plan are, 1st, the supplying meat as perfect as fresh, also with vegetable products added, as sugar, potash, &c., and, therefore, even better than fresh meat; 2nd, that its bulk is diminished from one-half to two-thirds, and it is therefore more portable; 3rd, that in the preparation any desired antiscorbutic can be added; 4th, the hide is cured at the same time as the carcase.

The process of the "British Meat Preserver Company" is allied to the salting method. A powder is dissolved in water, the meat is dipped in the solution, and afterwards dried. The solution has the property of restoring meat that is already tainted. By whatever process meat or fish may be salted it can be dried in the open air or in the drying rooms, or packed wet in casks in the ordinary way.

The second class of methods is that of drying. This is accomplished by currents of ordinary air, by air deprived of moisture by chloride of calcium or by passing over sulphuric acid. Chilled air is prescribed sometimes; at others hot air, and air at 138°. Some advocate complete, while many think that partial, drying is sufficient, to the extent of from 50 to 80 per cent. of the moisture. When thus much of the process is completed the joints are to be varnished with a strong solution of gelatine, or packed in boxes by pressure, the interstices filled with "concentrated liquor," the lids to be soldered on, and the whole submitted to a temperature sufficiently high to produce steam in the box. Various varnishes for covering the substances to be preserved have been advocated. These consist of gelatine, glycerine, treacle, elaines, oils, and even collodion, or dipping the provision into a thin cream of plaster of Paris, which, when set, is to be saturated with melted wax, suet, &c. More recently several other plans for coating meat, raw or cooked, have been propounded, such as covering the joint with gelatine, and then treating with oak bark, or

acetate of alumina, so as to form a coating of leather. Gutta percha in solution has been recommended also.

The third class is that of cooking the food to be preserved, either before or after being placed in the vessel containing it. In the first case one plan is that the cooked meat is to be put into wooden vessels, and extract of meat is poured over it, "in such a fusible state as to find its way into every vacuum." Another: flesh, fish, fowls, or vegetables, fully cooked, packed with hot fat or jelly, the vessels not to be heated after their apertures are closed. The preparation of essence of meat, concentrated soups, Soyer's osmazone food come under this head. The process of most interest and most commonly practised is that of cooking the food in the vessel in which it is to be kept. The meat, fish, poultry, game, or whatever is to be preserved, is introduced into a tin cylinder of convenient size, the top soldered on, and a small hole made in it for the escape of air and the steam generated during the cooking. These canisters are placed side by side in a bath containing a solution of chloride of calcium; heat is applied, and the temperature raised to between 250° and 280°. At the proper time, when the food is fully cooked and all the atmospheric air driven out, a morsel of solder is applied to the pin-hole, and the process is substantially complete. This is by far the commonest system of preserving fresh meat food of all descriptions, and in almost every form —soups, stews, boiled food, hashes, variously prepared, with the addition of vegetables, sauces, or other flavouring substances. There appears a difficulty about roasted joints, game, or fowls, which is provided for in this way:— The meat or poultry is cooked by being plunged into boiling fat for the necessary time; it is afterwards preserved in the tins in the usual way, with the addition of a little stock by way of gravy, or by being surrounded with fat. The cases are then cleansed, painted, to preserve the tin plate of which they are composed, and removed to a proving room, where they remain for a week or ten days, exposed to a temperature of about 90°; if the process has not been effective for the expulsion of all free oxygen, decomposition takes place, and instead of the ends of the canister exhibiting an indented form, they bulge out, on account of the new gases formed in the case by the putrefactive process. Such samples are, of course, condemned. If, however, they stand this test, they are conveyed to store rooms for future use. A variety of this plan has been introduced by Messrs. M'Call. After the meat, say a piece of beef, weighing 6lb., has been introduced into the tin, the lid—which has on its under or internal surface a small tin chamber having two pin-holes plugged up with a fusible metal, which melts at a temperature in excess of 212°, and containing a little block of sulphite of potash —is soldered down, a small vent only being left open; this is placed in the chloride of calcium bath at boiling heat; here it is cooked for three hours; when the operator considers the meat to be done, he solders up the pin-hole, thereby hermetically sealing the case. The heat of the bath is subsequently raised to about 270° for from 35 to 40 minutes; this increased temperature has the effect of melting the fusible metal plugs; the sulphite escapes into the case, absorbs any oxygen which may be present in it, and then mixes with the food.

I just mention, and pass over a means of preserving food from decay, by freezing or storing it in ice-houses, which can be only applicable under certain circumstances, as in camps, or when an army engaged in war has taken up winter quarters, or during a continued siege, &c. Food is thus preserved in Canada during the winter.

The knowledge that atmospheric air, or rather the oxygen contained in it, is the prime inciter to and supporter of decomposition, at once pointed out that it would be only necessary to get rid of this gas to arrest or entirely prevent the resolution of the aliment sought to be preserved. The means applicable for this end may form a fourth class. The principal are the following:—In 1810, Augustus de Heine took out a patent for applying "known principles to preserve animal food and other perishable articles a long time from perishing or becoming useless." The preserving vessels may be made of iron, glass, or any other metal, or of earthenware strong enough to withstand the pressure of the atmosphere when exhausted. In the lid there is a "protuberance, wherein a valve is fitted, that will let the air escape out of the vessel, but not suffer it to come in." It is exhausted by a particular exhausting machine. "The process with the common air pump" is said to be "tedious, and not to be relied on." The patent of John Bevan, in 1842, is for exhausting from the containing vessels all the air, by connecting the cases with a vacuum chamber on the one hand, and with a vessel holding gelatine or other suitable material on the other hand, in such manner that by opening the communications the air escapes into the exhausting apparatus, while the gelatine succeeds to supply its place. Again, in 1853 Alex. Robertson recommends his process, whereby the provisions are placed in a suitable vessel, with a "valve or door, opening on a hinge, and ground into its seat, so as to fit air-tight." The provisions are placed in it, the door is closed, and the air is then exhausted from it by means of an air-pump. An invention in 1855 was for "certain new and useful apparatus for exhausting, by means of a pump, and closing vessels in which vegetable or animal substances are to be preserved or improved by being placed in a perfect vacuum."

The fifth and last class of processes I shall mention appears to me the most important, as they fulfil more or less perfectly the requirements needed for the absolute expulsion of all atmospheric oxygen, and at the same time the substitution of a new atmosphere, composed variously of preservative gases, of course to the total exclusion of free oxygen. The first process having this object in view was patented in 1836. "The meat, raw or partly cooked, must remain in a mixture of salt and nitre" for a given time, "then be placed in tin cases filled up with brine, and turned over a vat of the same liquid, to introduce carbonic acid gas, for which purpose a pump may be used, or the gas may flow by a tube." Instead of making a vacuum by an air-pump, a small bag of nails, or iron filings, must be placed in the upper part of the vessels; the air will then be deprived of its oxygen. In the same patent other gases are mentioned as useful, "such as deutoxide of azote, hydrogen, and azote; other patents recommend the adoption of various compounds, such as carbonic acid gas, with hydrochloric or pyroligneous acids; sulphurous acid, in the form of gas and in solution; the vapour of alcohol, with or without carbonic acid; and "gaseous binoxide of nitrogen;" "nitrous acid gas and sulphurous acid gas, either alone or in combination." One of these, by Hippolyte Lamy, attracted much attention at the Paris Exposition in 1855. The title was "Certain improvements in preserving animal and vegetable substances;" and consisted in the introduction of sulphurous acid gas into the vessel containing the substance to be preserved; any acid taste engendered by this process was to be neutralised by a solution of baryta or bicarbonate of magnesia. I understand that this invention was not successful; that about 50 per cent. of the meat put up turned out bad. After several schemes and various composition of gases, all having for their object the absorption of atmospheric oxygen, had been tried, Messrs. Jones and Trevithick introduced a plan of, 1st, exhausting all, or very nearly all, the air from the chamber in which the meat to be preserved was placed; 2ndly, supplying the place of the air by pure nitrogen gas to nearly the capacity of the canister; and 3rdly, injecting a small measure of sulphurous acid gas. The *rationale* of this process consisted in getting rid of the oxygen by exhaustion to as great an extent as possible, and neutralising any that might remain either in the case, in the bone, or in the tissues of the meat. This is certainly a purely rational system of procedure, and only requires the proof of experience to mark it as excelling most, if not all, others, for it must, I think, recommend itself to all of us in that, if successful, it preserves to our use the meat, &c., in that fresh raw state most suitable for after cooking in any

way that may be deemed most desirable. It gives us also an opportunity of ascertaining the quality of the meat preserved. This none of the cooking processes can well accomplish. You may recollect in the Exhibition of 1862 there were some specimens—under the title of "Azotised raw meat,"—of fresh meat, salmon, &c., put up in glass cases; and I can well remember how anxiously I watched them from time to time, to see how the samples would bear the severe test of exposure to the heated atmosphere, and sometimes the sun's rays in that building. Not one example failed. Mr. Jones has kindly sent some samples prepared by his process, which are before us on the table, and a model which explains practically his method of putting up the provisions.

Since 1862, however, certain improvments in the preserving matters used, or in their application, have been effected. At the present time, the method of procedure is thus carried out. The gases to be used are previously prepared and tested as to their purity and usefulness; the cases are accurately made, so as to be air-tight, a small tube of flexible metal being placed in the bottom, and another in the top of the case. The meat to be preserved is then placed in the tin, and the top soldered down very securely; to the metal tubes are attached pieces of vulcanised india-rubber tubing; the cases thus prepared are then ready for the next step. The free ends of the elastic tubes are now attached to the extremities of metal pipes; by one the case is filled with water deprived of all free oxygen; this drives out all atmospheric air. The water is now shut off, and a stop-cock is opened, which admits nitrogen gas into the case, displacing in its turn the water it contained. Should it be thought desirable, thus much of the process can be repeated. The nitrogen that first filled the case is not wasted, but is conducted by a pipe into a spare gas holder for re-purification and future use; afterwards a measure of sulphurous acid gas is injected into the tin, proportionate to the space unoccupied by the meat; the quantity required is estimated, and is a matter of experience and calculation; then the flexible metal tubes are closed by being nipped, folded over, and soldered; the tin cases are then painted, labelled, and tested.

M. Pasteur's experiments go to prove that the germination of the sporules of cryptogamic plants floating in the atmosphere may take place in an atmosphere destitute of oxygen, but this is very unlikely to occur when with the absence of oxygen there is the presence of sulphurous acid gas; the same remark will hold good with respect to the ova of vibriones, or other microscopic animals.

In describing this process it may appear complicated and tedious, as well as uncertain, but in actual practice it is not so; it is carried out with the greatest facility, and is the one above all others capable of the greatest despatch. The cost of the materials is very slight, and the expense of necessary plant certainly not greater than that of the cooked meat plan, while there is no necessity for furnace, steam heat, or engine.

As may be well seen by the beautiful specimen (a head of cauliflower in a glass case) on the table, vegetables may be preserved whole, fresh, and in their natural condition, without the slightest sign of decay, and with all the colour and freshness of a recent sample purchased in the market. The specimens of meat, consisting of a section of beef, mutton chop, &c., all under glass shades, give undoubted demonstration that this proceeding is certainly most efficient. The lean is unchanged in colour and consistence; the fat is free from any change, there is no appearance of rancidity or formation of adipocire; and they look as if just cut from the joint.

Having now given a resumé of certain processes for preserving meat, &c., it will be as well to glance at the chemistry of animal flesh, in order that we may more readily comprehend in what particulars these have attained or fallen short of their object.

In the living animal, the constituents of flesh and other structures are held together by the principle of life and constant renewal and repair; as soon, however, as life ceases, these principles have a tendency to resolve themselves into new compounds by the union of their elements with atmospheric air and with one another. Raw flesh contains, according to Baron Liebig:—

76 to 79	per cent.	of water.
2 ,, 3	,,	of soluble albumen.
17 ,, 18	,,	of fibrine and insoluble matters.

If a piece of flesh, recently cut from a joint, be placed upon a plate, a fluid begins to drain from it; this consists of water, holding in solution albumen, free lactic acid and salts of lactic, phosphoric and inosinic acids, with the alkaline bases of potash chiefly, with soda, lime, &c., and blood. This juice, which may be looked upon as the active principle of meat, may be obtained by cutting lean raw meat into pieces, bruising them in a mortar, pressing the pulped meat in a coarse cloth, so as to squeeze out as much as possible of the fluid parts; by repeating this process, with the addition of a small quantity of water and evaporating the liquid obtained, we get a true extract of meat, which is only $\frac{1}{32}$nd part of the weight of the original mass. This means it can scarcely ever be necessary to carry out into practice, except, perhaps, in a few urgent medical cases, its very expense being a great objection, and the end gained not being equivalent to the trouble and cost. The juice of flesh is found to be very rich in the salts of potash, and to contain but small quantities of the salts of soda, while blood itself contains chiefly the salts of soda, and but a very small proportion of the salts of potash. In the ox, Liebig states that for every 100 parts of soda contained in the body there are 59 parts of potash in the blood, and as much as 279 parts in the flesh. Salting reduces the meat of young animals, which is rich in albumen, to the condition—more or less aggravated according to the extent to which it is carried—of the flesh of very old animals; by abstracting albumen the meat is rendered less sapid, the fibre is made drier, harder, and less digestible, and, for this, and coupled with the reason that the greater part of the nutritive element is abstracted, less fit for the animal economy. By the ordinary method of salting, the fluid and more soluble matters contained in flesh are abstracted and are most frequently wasted, the salting-trough or brine-tub being periodically emptied, cleansed, and fresh salt or brine made use of; and in the case of provisions packed in casks with brine, very many of the best constituents of the meat are abstracted, and finally thrown away.

The medical aspect of this subject is full of interest. It is well known that scurvy, a debilitating and fatal disease, is brought on by the use of a diet containing but very little potash, which we have noticed above to be a principal base of the salts contained in meat, and which is abstracted largely by the ordinary process of pickling. The evident remedy, and one which acts with magical efficacy, is the supply of the potash so much required by the animal economy, in the form of lemon juice, (as recommended so far back as 1780,) of sound potatoes, or other vegetables. At the time of the cotton distress and famine in Lancashire, when so many of the poor were compelled to live on a very moderate quantity of flesh food, and that principally in a salted condition, it providentially happened that the crop of potatoes was a very good one, and the price in consequence much lowered, thus enabling the poor, or those who provided the poor with food, to obtain this antiscorbutic vegetable at a more moderate rate. Baron Liebig has a paragraph very apt to this subject. He says, "It is obvious that, if flesh employed as food is again to become flesh in the body; if it is to retain the power of reproducing itself in its original condition, none of the constituents of raw flesh ought to be withdrawn from it during its preparation for food. If its composition be altered in any way—if one of the constituents which belong essentially to its constitution be removed, a corresponding variation must take place in the power of that piece of flesh to re-assume in the living body the original form and quality on which its properties in the living organism depend."

The practice in use by the large contractors who supply stores for the Government and our merchant marine, is to cut up the carcase of the animal into pieces of 8lbs. for beef and 4lbs. for pork; these are well rubbed with dry salt, then placed in tanks, with dry salt, for at least ten days; the fluid parts of the meat, of course, ooze out and form a brine with the salt, a portion of the salt penetrating and hardening the meat; it is then placed in barrels, more salt being added at the top and bottom of each cask. From what we have observed above, this very rude procedure is evidently a wasteful and objectional process.

Mr. Whitelaw, of Glasgow, has introduced a process for utilising the brine of cured meat. He remarks that fresh meat, after having been sprinkled with salt and left for a few days, is found swimming in brine. This expelled water was saturated with the soluble nutritive ingredients of the flesh; it was, in fact, a juice of flesh or soup, with all its valuable and nutritive properties. In large curing establishments, very considerable quantities of brine are produced and thrown away. To this material, Mr. Whitelaw has applied the process of dialysis, for the removal of the salt in the brine and the production of pure extract of meat at a cheap rate. He recommends the use of ox bladders with stop-cocks, hung on rods stretching across and into vats of water. The bladders were filled with filtered brine, and the water in the vats changed once a day or oftener; and he found that by the third or fourth day the saline matter was removed, and the liquid contained in the bladders was prime juice of flesh in a wholesome condition. This might afterwards be treated in different ways, according to circumstances; made into soups for immediate use, or evaporated at a low temperature, say 120°, for future use. He found that two gallons of brine yielded 1lb. of solid extract, equal to more than 20lbs. of fresh meat. He estimated that in Glasgow alone 60,000 gallons were annually thrown away. At the moderate calculation of one gallon being equal to 7lbs. of meat for the production of soup or extract, there was then a yearly waste of 187 tons of meat without bone, and which, at 6d. per pound, would give a money loss of £10,500 per annum. He has also used the same process for the reconversion of salt into fresh meat, by introducing into a proper dialysing bag the joint, and nearly filling it up with the brine; the fresh water extracts the salt from the meat through the brine, and the meat resumes some of the fluid extract it had formerly lost, to the extent, he says, of nearly one-third. Meat thus treated may be cooked in various ways that are not applicable to salt provisions.

Some notice of the charqui introduced into this country by the South American Beef Company and Mr. Madden will here be necessary; and, as we have been pretty well informed of the vast quantities of good wholesome meat in Brazil that only requires a market, the attention of all has been, for various reasons, turned to that quarter and to that subject. I shall endeavour, then, to be as brief in my remarks as the importance of the subject will permit. The process for preparing the charqui is as follows:—The meat cut from the carcase in slices is thoroughly salted with dry salt for 24 hours in stacks, on floors, which are channelled, for carrying away the brine into cisterns; it is afterwards thoroughly dried by exposure on rails in the open air. This forms the dry or original charqui; but a new plan has been used lately, viz., that of salting and pickling the meat with the bones, in pieces of about 12lb. weight, and packed in casks for transportation to this country.

South America afforded an admirable field for testing, on a most extensive scale, the process of salting introduced by Mr. Morgan, who stated in his paper, above referred to, that "an agent had been sent to Monte Video to practise the mode of preserving meat." As above stated, no large quantity has been received in this country.

An anonymous writer, I assume it to be Dr. Hassall, has recently, in a paper in the *Lancet*, spoken favourably of both forms of charqui, although he allows that in salting "it sustains a loss of a portion of its nutritive materials." An entertainment was prepared a short time ago, at which all the dishes, consisting of soups, Pemmican and other preparations were made from the South American beef; the results were variously reported. Dr. Hassall says, "the dishes were palatable and free from any perceptible taint, with the exception of the stewed beef, and such, in fact, as no hungry person would decline to partake of." Others I have heard complain of a certain mouldy, fusty flavour which even the excellent cookery of Mr. Warriner was incapable of concealing. In mentioning that gentleman's name, I must acknowledge the assistance he has rendered me in preparing this paper, and in providing the different specimens of preserved food exhibited on the table before you. I had proceeded far into my notes on charqui when the *Times* of the 7th current reported the seizure of about two cwt. of this dried kind of meat at Mr. Twelvetrees', in Bishopsgate; this was condemned by the Lord Mayor, and burnt as unfit for human food. I have made inquiries as to the opinion of the poor who have used it in either form, and find there is an almost universal opinion against it, both from its appearance and unsavoury smell in the raw state, but on the latter account more especially when it is being cooked. I am afraid that this South American beef, in its present forms and method of preparation, will never commend itself to the stomachs and appetites of our people. The decision of the Lord Mayor above mentioned appears to have been considered a heavy blow and great discouragement to those interested in the sale of the South American beef, for, in addition to the palliative advertisements that have appeared daily, a deputation of Liverpool merchants is about to remonstrate with the Lord Mayor concerning his decree for the destruction of the meat seized.

The analysis of the different samples of South American beef, compared with fresh and salted English beef, given by the abovementioned writer, is as follows:—

	LEAN ENGLISH.		Dried Charqui. Mr. Madden's.	Approximate correction for loss of water.	Dried Charqui. S. American Company.	Approximate correction for loss of water.	Rolled Charqui. S. American Company.	Approximate correction for loss of water.	Pickled Charqui. S. American Company.	Approximate correction for loss of water.
	Fresh Beef.	Salted Beef.								
Water	73·33	70·438	33·820	70·48	29·70	70·48	46·690	70·48	59·00	70·48
Fat	4·08	4·374	2·958	1·31	10·41	4·38	7·995	4·44	12·17	8·6
Nitrogenous matters, Fibrin, Albumen, &c.	20·76	18·170	40·954	18·26	39·69	16·72	27·500	15·17	15·40	10·97
Ash	1·20	6·165	20·456	9·12	18·55	7·81	16·860	9·31	11·37	8·
Undetermined matters.	0·63	0·803	1·812	·83	1·65	·61	·955	·60	2·06	1·46
	100·00	100·000	100·000	100·00	100·00	100·00	100·000	100·00	100·00	100·00

I have endeavoured to make an approximation of the analysis, in the dried or partially dried samples, to the standard of recently salted English meat, and the figures tally pretty nearly with those of the assumed standard. In all the specimens of charqui there is an excess of saline matters over and above what is necessary for curing the meat, but added, doubtless, for the sake of better guarding against taint or rancidity. This obtains to the greatest extent in the sample of rolled charqui, where the meat would, from its damp condition and exposure, require a greater amount of the preservative matters. A sample I inspected the other day, obtained from the Company, although freshly cut from the middle of a roll, and strongly impregnated with salts, insomuch that large portions of the crystals were sticking in the interstices of the meat, and the cut surfaces after a very short exposure became covered with powdery efflorescence of salt, had a very unpleasant smell resembling the odour of a small country chandler's store, and due, without doubt, to the partial decomposition of the fat of the meat, whether lying external to the muscles or in their substance, and the generation of some of the fatty acids which may be found to be deleterious. The dry charqui comes over to this country in bales. If it has been packed when not perfectly dry, or should it have become damp from any cause, the inner portions of charqui in the bale become heated and corrupt; or if no accident of this kind occurs the meat is attacked by mites. All the charqui brought over to this country has been cured not less than nine months. The fat is in excess of that in the English specimens in all the samples, except the dry charqui of Mr. Madden, and mostly so in the pickled beef; the sorters of the dry kinds at Liverpool cut off as much as possible of the fat, for which they obtain a better price than for the meat itself. As we might have inferred from what has been said of the effect salting has upon meat, viz., the abstraction of much of its water, and, dissolved in that water, of a great quantity of the soluble nutritious qualities of the flesh, so we see in the pickled beef that there is a manifest depreciation in the per centage of the nitrogenous principles; this depreciation in the nourishing proportions of the pickled beef requires some correction, as there exists a quantity of fat to the extent of double that of the English specimen; with this correction, however, the meat has undoubtedly lost a large proportion of its best constituents. In the case of the dried charqui of Mr. Madden, there appears to be an excess of the flesh-formers, but, again, due allowance must be made for the small quantity of fat. Taking this review of the South American beef, it must be evident that the meat *per se* is of good quality—very fit indeed for nourishing and invigorating our masses, but that some much more perfect system is required to preserve it before a ready market will be obtained for it here.

There appear, then, but three principal methods at present in use for preserving animal food from decay. The first, that of salting, certainly has some advantages, viz., that of being readily accomplished, and under almost any circumstances, although meat simply salted and dried can only be preserved for a limited time, the fat after a while becoming rancid, while the lean splits up from overdrying and offers an eligible habitat for insects, or if kept moist, mould and confervæ may infest it. The acids and oily compounds generated by slow combustion of wood, carried out in the process of smoking salted meat, are greatly conducive to the preservation of this form of provision. When salt provision requires to be kept a long time, it is necessary to put it into casks with pickle. In this form it is most available for carriage, export, or import, but the same objection holds with regard to all salt meats, as has been shown above, that they are less nutritious and have lost some principles which are necessary to the animal economy, so that if the use of salted meats is persevered in without the due supply of fresh vegetable food very grave consequences result.

The second method, that of preserving cooked meats, &c., is one that cannot be spoken too highly of; the process has borne the test of experience for years; the cases have been carried into every latitude; they have neither burst with the heat of the torrid zone, nor collapsed with the cold of the eternal snows; and whenever or wherever the contents have been required they have been available. This offers an admirable method of preserving, and at the same time cooking, food for import and for victualling. The food can be as varied in its form and combination as heart can desire, and the only drawback is the fear lest the food thus prepared should be over-cooked; this is evidently the greatest danger that can be conceived likely to occur, and one which undoubtedly does sometimes happen; yet an experienced and instructed cook ought to be able to carry out this process without so hardening the fibre of the meat as to make it injurious.

The third plan, viz., that of preserving raw meat by substituting an artificial and preservative atmosphere for that of common air, has, as I have before mentioned, many desirable qualities to recommend it. There is an opportunity of ascertaining the quality of the meat, poultry, &c.; the joint is to all intents and purposes as if just purchased at the butcher's shop; it contains all its ingredients and elements in a purely natural and unchanged condition, and in the state best adapted for nourishment; other advantages are the small cost of the process, and the speed with which it is accomplished; not the least being that the consumer is at liberty to cook his joint in any way most convenient or most desirable to himself. It is the only process of preserving by which we can obtain a roasted joint with all its appetising aroma, sapid gravy, and tempting brown exterior when served; it may be under the shadow of the pyramids, or on a Christmas day in the far north, to the delight and solace of some possible Arctic expedition. This process appears to be exceedingly applicable for the import of fresh raw provisions from countries where they can be obtained at small cost. It is available for putting up meat cut into joints suitable for the consumer, while it is not necessary to separate the meat from the bone, so that the shape and natural appearance of the joint are well preserved. The cases might be received in this country by the consignee, and the meat removed from them and dealt with as if just purchased at the carcase butchers, or, while in the cases, it might be transferred from town to town, as occasion might require; or, on the other hand, the meat would be in a ready and safe form for victualling armies or supplying ships. Indeed, whole carcases might be packed singly or in numbers in tanks or in caissons furnished with taps; these might be treated in exactly the same manner as the tin cases for joints—instead of soldering on the cap it could be made air-tight, by means of binding screws, washers, &c. Suppose, for the sake of illustration, that a factory was established in any district where animal food might be found in great plenty, all the best portions of the animals, the joints, might be preserved and put up raw by the atmospheric process, while the parts not available for that procedure could be made into stews, curries, soups, ragouts, &c. These cases, both of raw and cooked food, might be then transferred hither and thither where most needed. Such a plan is about to be carried out by a company recently established, who will have a factory or factories abroad, and who are just starting a like business at home. They propose to purchase the cattle, pigs, poultry, fish, game, &c., at first hand, to slaughter and dress the cattle, and after preserving the finest joints by the raw-meat process, to put up the remainder by the cooking method. This will ensure all portions used not only to be fresh and free from taint, but to be obtained from healthy animals, and therefore most fit for human food, and conveying into the system the largest relative amount of nutrition.

It becomes a matter of necessity that this plan, or something like this, should be adopted, for we cannot shut our eyes to the growing wants of our population. The increased cost of animal food indicates a supply

not commensurate with the demand which may arise on the one hand from the wondrous increase of our own population, about 200,000 per annum, while there are but 60,000 who emigrate, one-third of these being English, thus leaving a yearly surplus of 140,000, without taking into consideration the immigration of foreigners; on the other hand, from the difficulty of supply of live stock or carcases from foreign countries, the cost of freight adding so much to the first cost of the animals if they have to be brought from greater distances than at present. Mr. R. Herbert, in a paper read before the British Association, at Bath, in September, 1864, remarks on the increased demand for meat due to "the rapid increase of the population of Great Britain during the last ten years, and the consequent increase in the consuming powers, added to the extraordinary progress of trade and commerce, the improved monetary position of the great mass of meat consumers, proving beyond doubt that the period has now arrived when strenuous efforts are absolutely necessary to meet a demand that must continue to have a most important bearing upon price. At the present time both beef and mutton are selling at full 1½d. per pound above the rate current ten years ago. Prices are still tending upwards, and had it not been for a free importation nearly all kinds of meat would, long ere this, have been selling at enormous prices." The following table of the cost of meat per stone of 8lbs. will give the difference of prices at ten years' interval:—

	1853.	1863.	Average for 1853.	Average for 1863.
	s. d. s. d.	s. d. s. d.	s. d.	s. d.
Beef	2 6 to 5 0	3 4 to 5 2	3 9	4 3
Mutton	2 6 „ 5 4	3 6 „ 6 2	3 11	4 10

I believe the increase is more evidently shown by the prices of last year and the commencement of the present.

The supply, too, of foreign animal food is becoming much larger year by year:—

	1853.	1863.	Increase.
Beasts imported	125,253	150,898	35,645
Sheep and lambs	230,037	430,788	200,751

Calves and pigs also have been brought over in great and increasing numbers.

It is calculated that in London alone with, its 3,000,000 inhabitants, there are consumed—

Beasts	250,000
Sheep and lambs	1,500,000
Calves	20,000
Pigs	400,000

It is a question of policy for the government of any country to see that its inhabitants are well supplied with wholesome food and in sufficient quantities. We are noted, as a nation, for the wonderful appetites we possess, and the appreciation we have for the best quality of food. Much might be done however towards husbanding the supplies we already have if a better and a more common-sense plan of cookery were adopted by all classes, but especially the poor. It is more than likely that our position among the nations is not a little due to this national taste for good, strong food and plenty of it. If, then, our energies of body and mind are to be kept going it is absolutely necessary that proper supplies of aliment should be forthcoming, and if this is not to be had at home we must go to other countries to seek for it. Good food is necessary, moreover, to good health. Unless our bodies are duly supplied with means to sustain the waste, they must become diseased and so decay. Witness the very marked difference of mortality amongst our troops in the Crimea and in Canada. In the former place, through our inexperience of war's requirements, or some other cause, proper attention was not paid to the victualling and hygienic necessities of the soldier; the dire consequence was that multitudes died of disease, while comparatively few succumbed in consequence of wounds; in the latter instance, that of the regiments sent to Canada at the commencement of the present civil war in America, the troops were more tenderly cared for with regard to diet, clothing, quarters, warm food being ready for them after a march, extra rations of meat, fur jackets, flannel under clothing, &c. The consequence was that in a march during severe cold varying from 64° to 10° F. below the freezing point, Dr. Miles reported, "it is a remarkable and astounding fact that thousands of British troops, at the rate of 160 or more a day, have been during several weeks marched over a wide frozen desert of snow extending for more than 319 statute miles, yet during the whole of that journey, in all weathers, no single death had been induced thereby." He speaks also of the enormous appetites of the men, that they were eating morning, noon, and night. It has been calculated that a private soldier landed in India is worth to the state in money £100, that is to say it would cost so much to replace him in case of death; is it not, then, a false economy that withholds from that man anything that tends to his health and physical support? Moreover, if the soldier who protects what we possess is represented by such a sum, surely the civilian who produces wealth is of equal value. I trust the time is not far distant when our Government will no longer issue to the army and navy the accustomed supplies of salt provisions, but that with our present knowledge of processes for the ready supply of provisions in such condition as to be best adapted to support a sound mind in a healthy body, fresh food will be furnished to the well-being of our gallant defenders and the prosperity of the nation.

I may here observe that, from a comparison of the percentage of committals of criminals with the price of provisions, there appears to be a relative increase of crime when the food is high, and a decrease when food is cheap:—

	Metropolitan Districts.	England and Wales.	
1856	3·2	19·4	Dear food, foreign war. High interest, severe crisis.
1857	3·1	20·3	
1858	2·7	17·9	Cheap food. Low interest. Good business.
1859	2·9	16·7	
1860	2·8	16·0	
1861	3·0	18·3	Dear food and money. Scarcity of cotton. American war.
1862	3·6	20·0	
1863	—	20·8	

While in our densely-populated towns and districts we can scarcely supply sufficient cheap food for the bodily sustenance of our labouring population who chiefly require good animal food, while meat can only be obtained at an almost exclusive price to the poor man, and that meat frequently of but very indifferent quality, and while at the same time there exists in other regions of the earth a superabundance of animal food not only fit for sustenance but of excellent quality, it should be the duty of every philanthropist—to say nothing of mercantile and social interests—to make use of the abundance of one part of the earth for the supply of the necessities of another part, and thus act up to the precept of our great Exemplar, who required his followers to gather up the fragments, that nothing should be lost.

DISCUSSION.

Mr. Wentworth Scott remarked that by scarcely any known process for the preservation of food coul all the nutritious qualities be retained, and this was the great end to be sought for. He had made a great number of experiments on this subject, but he had been able to bring with him only one specimen preserved by a process of his own. There were many processes by which both meat and vegetables might be preserved from decomposition, but these very generally produced a more or less disagreeable flavour, and he thought that remark applied to some extent to the foods prepared by Messrs. Jones and Trevithick. The specimen on the table, prepared by himself, consisted of a piece of veal which had not been

subjected to any process of cooking whatever. The air enclosed in the canister was atmospheric, but it was deprived of the elements of fungi and animal parasites by being exposed for a time to a temperature of 800° Fahr. It was then cooled and passed into the vessel containing the meat. After the meat had been "soaked" (so to speak) in that air for 24 hours, the air was removed from the case, and it was then re-charged with more "prepared" air, and a few drops of liquid ammonia were added to the contents of the vessel, which was then screwed down air-tight.

Dr. HIRSCHFELD said he would not refer to the theory of this subject, but having on several occasions had the opportunity of testing different meats prepared by Mr. Jones's process, such as beef, mutton, ducks, and fowls, he could bear his testimony to their perfect freedom from the least taint from the gases employed in the process of preservation, and he considered the meats were as good as if they had been perfectly fresh.

Mr. WARRINER said, as a practical cook, he might be able to throw a little light on a matter which seemed so generally interesting as to have brought together such a large audience on this occasion. With reference to the preserved viands, of which those present would afterwards be invited to partake, he had no doubt they would be found excellent. It was now nearly 20 years since he received the Isis gold medal of this Society for the introduction of the concentrated essence of meat, a distinction which he should feel proud of to the latest day of his life. His object in rising was more particularly to call attention to the process of Mr. Jones, by which raw meat had been preserved in a good sound condition for more than three years, and the process, as witnessed by himself and Dr. Letheby, the officer of health for the City, was extremely simple, and the only wonder was that it had been so long overlooked. Raw meat could be obtained in Russia, in South America, and other parts of the world, at a half-penny per pound, the only additional cost being the preservation and the transport to this country, besides the profit to the dealers, which in London was much higher than in any other place he knew of. With regard to the charqui he was not in a condition to say very much about it; at the same time, if it could be brought to this country in a good condition, and in perhaps a somewhat more tempting form, it would prove a great boon. He would suggest that they should feed convicts on charqui, and leave the English beef and mutton for the honest labouring population. He felt convinced that the price of meat in this country might be greatly reduced from what it now was, if men of science would only give the attention to the subject which its great importance demanded. It was the duty of every one to endeavour to lower the price of the staple articles of food, so as to bring them within reach of the great masses of the population. He did not decry charqui because of its untempting appearance; but the great question was whether it contained the necessary nutritive qualities which all food should possess to make it really valuable. They would have an opportunity of tasting soup made from both charqui and English beef, and he would leave them to decide which they liked best.

Mr. FRIPP, as the representative of the South American interest in Liverpool, said he had listened to the paper with great interest, and he thought the various processes brought under their notice had been very fairly and truthfully described, each standing on its own merits. He had probably had more to do with the imported South American beef than any other person, having received large consignments, all of which had been consumed. The other description of preserved meat with which he had a good deal to do was that prepared by Mr. Morgan's process of salting, and he had that day partaken of a dish of stewed mutton from Australia, preserved by that process, which for flavour and good condition was all that could be desired. He believed they were on the eve of a different state of things with regard to animal food in this country, and if only a fair trial was given to the various foods brought before them this evening, and if popular prejudice was not allowed to prevail, they would have the means of largely increasing the supply of animal food, which was allowed by all to be greatly needed, and would thus add to the welfare and comfort, as well as to the wealth of the country.

Mr. KEELING remarked that the great object was to ascertain some means by which animal food might be obtained at a much cheaper rate than at present. The labouring populations of France and Germany were taught to economise food to a far greater extent than the poor of this country, and, generally speaking, he believed the people were more economically, and at the same time more nutritiously, fed in those countries than in England. The greatly enhanced price of animal food in this country at the present time was a matter of the most serious importance, and unless some effectual means were taken to counteract this, the price would go on increasing. The importance of this question had been increased by the disastrous civil war in America, by reason of which large supplies of animal food had ceased to find their way across the Atlantic. If means could be devised by which good animal food could be brought into this country for general consumption, it would be a most desirable thing, and would supply a great want of the present day, and those who succeeded in effecting that object must be regarded as public benefactors.

Mr. WINTER wished to know whether the preservative processes introduced to their notice this evening were to be regarded as novelties? He had given attention to this subject for some years; and seven years ago he preserved meats and fruits in their natural state by machinery, which he should be happy at any time to exhibit to those interested in the subject.

Mr. W. V. VENABLES expressed the great delight which he and other sojourners in distant countries had experienced from the means which were afforded them through the various preservative processes in use, of regaling themselves with home delicacies. This, he said, was particularly the case with regard to salmon, which was now procurable almost everywhere.

Dr. EDWARD SMITH, F.R.S., said he would refer more particularly to one kind of preserved meat, charqui, for it appeared to him very desirable that they should, if possible, come to some conclusion as to the real value of that description of food. Some three years ago there was reason to hope that the vast stores of animal food in South America would be made available for this country, but he was sorry to see the result had not equalled the expectations in that respect. One important element in the case had been omitted both from the paper and the discussion, that was the price at which that food could be sold in this country. It was originally introduced with the catching announcement, "Beef at 3d. per lb.," whereas, when they went to buy it retail, they found it was 4d. per lb., which made the greatest possible difference. This description of meat was never intended to come into competition with the sirloin of beef and the leg of mutton, which were the food of the rich; but if there was any use in its introduction at all it was in competition with the inferior parts, which for the most part fell to the lot of the poorer classes as being within their means. The poor man was now able to buy on a Saturday night his piece of brisket of beef at 5d. to 5½d. per lb., ox heart at 4d., and liver at 2d. to 2½d. per lb. Without going into the question whether these were the best representatives of animal food, they were certainly the most available for the poorer population, and he thus conceived that the South American beef came into competition with them alone. It seemed to him a great mistake to allow that kind of meat to be sold so high as 4d. per lb. If the meat could be obtained almost without cost in the countries where it was produced, and if the cost of curing—especially by the process of Mr. Morgan—was so small, to which only had to be added the expense of transport, he was quite

sure it could be sold in this country at 2d. per lb., and leave a fair margin of profit to the dealer. If that were done the complexion of the whole subject would be changed. Now, with reference to charqui itself, as now imported, they had heard very truly that the salting diminished its nutritive value, and the specimens before them were very highly salted; even if they soaked this meat for 48 hours, frequently changing the water, there was still salt remaining. He had treated it in that way, and then simmered it gently for 12 hours, and it then remained almost as hard and dry as it was at first. The hardness and saltness were both bad qualities, the former showing the absence of the nutritious elements of meat and the excessive amount of fibrine; and the latter exercising a prejudicial effect upon the human frame, inasmuch as an excess of saline matter was injurious to the nutrition of the body. Then came the question whether the amount of nutrition that was left in the meat, in the shape of nitrogen, existed in a digestible form. Here they had a material so extremely hard that with no amount of soaking and careful cooking could they reduce it to a condition which would bear comparison with fresh meat. They might be sure a large portion of the fibrine passed away from the system undigested: therefore, instead of this meat being more nutritious than fresh meat, as had been in some cases erroneously asserted, it was very much less so. This subject bore indirectly on the introduction of food into prisons and workhouses, but it would be no economy to introduce a description of food that would not supply an equal amount of nutriment for an equal amount of money to that now spent for fresh meat. It would be the dearest food that could be used: food which was hard, salt, and indigestible, at 3d. per lb., was, in fact, a dear food. This description of food was said to have been imported principally with a view of benefiting the poorer classes, but it must be remembered that no benefit would accrue if there was a difficulty in cooking it. In many districts the fuel of the poor consisted merely of furze, brambles, and hedge-gatherings, and therefore the lengthy cooking which this description of meat required was all but impossible to them. Then, again, came the questionable flavour of this South American beef as at present cured. Of all classes of the community the poor were, perhaps, the most dainty. In this case they had a food hard and indigestible. The flavour was removed by the excessive salting process, and cook it as they would there was an exceedingly small amount of taste in it. To his mind it was impossible that this article of food in its present form could ever become acceptable amongst the people. The higher classes did not want it, and the lower classes would not eat it. What they all desired was to see a large amount of wholesome and palatable flesh food introduced into the country at prices which would compete with the lower-priced joints of fresh meat.

Mr. G. F. WILSON, F.R.S., wished to state, after what had fallen from Dr. Smith, that he knew an instance in which South American beef was tried in a workman's colony at Birkenhead. It was bought at something less than three-pence per lb., and when made into soup was considered to be good.

Mr. MADDEN said his name having been mentioned in the paper in connection with the subject of South American beef, he wished to state that he had done his best to make it as popular as possible. Alluding to the public entertainment recently given by him at the London Tavern, consisting of various preparations of charqui, Mr. Madden stated that it was partaken of by 2,000 persons, who went away "quite satisfied," and the cooking occupied very little more than twelve hours. With regard to the price of the meat, he was prepared to supply portions of 7lbs. at 3d. per lb., and if anyone wished for a large supply he would furnish him with 100 tons at 2d. per lb. With regard to Mr. Jones's process, he would say he never partook of better tasting food, and it ate as fresh as if the joints had only just been obtained from the market.

Admiral Sir E. BELCHER said, having been accustomed to the use of preserved and salted meats for over half a century, he might be supposed to know something of their value amongst seamen. In the Arctic service the men preferred salt meat to the fresh meat preserved in tins; of the latter the beef steaks only were in favour, the mutton and soups being entirely eschewed. Charqui, in his opinion, could not, by any possible means, be made a food for the army or navy. It produced thirst, it required a great deal of fuel to cook it, and was not so nutritious as other foods. He had had charqui privately prepared for him in South America, and it was esteemed at the captain's table, but the men would not touch it. For the officers it was an agreeable change of diet from the salt beef known as "mahogany" (which was infinitely more difficult to "work up" than charqui), to have the preserved meats which were now taken out in all ships, and available in all climates. The consumption of animal food by men in the navy and soldiers abroad was much less than the average at home; and in the Arctic regions, travelling over hundreds of miles with the drag rope, with an allowance of three-quarters of a pound of meat per man per day, and the usual rations of biscuit, the men were in a more plump condition than when they started. Amongst the earlier forms of preserved meat was the patent of Mr. Payne, and he had used provisions prepared by that process with great satisfaction on the north-west coast of America. In the early part of the present century, the admiral in command on the West India station introduced a method of preserving meat in hot climates by simply rubbing it with sugar, and then allowing it to drain for a short time, afterwards packing it in dry salt in a cask. He induced the government to try that plan, and the whole of the meat used in the Arctic expedition in 1852 was cured in that way, and remained good throughout. In addition to that he took as a reserve several casks of beef prepared by Mr. Hogarth in February 1852, and in December of the same year he had roast beef as fresh as if it had just come from the butcher's shop. In the August following he had rump steaks from the same beef, and in the December following roast beef again. A preparation of meats with pyroligneous acid had been successfully adopted by Sir Thos. Cochrane, the meat being used many months afterwards in tropical climates, and found to be perfectly good. Having referred to the meat biscuit rations served to the soldiers in America as a nutritious and very portable form of food when on march, as also to the truly American rapidity with which the carcase of a bullock was compounded with flour and converted into that form of food, Sir Edward Belcher, reverting to the subject of charqui, remarked that when he was on the western coasts of America, he found that really good charqui never required more than twelve hours' soaking; being put into cold water at night it was fit to be cooked the next morning. Placing the meat in warm water did not soften it, and the best mode of softening it was by repeated changes of cold water.

Dr. BACHHOFFNER remarked that he was conversant with most of the processes adopted for the preservation of food; and with respect to Payne's process, alluded to by the last speaker, notwithstanding all the care and expense bestowed upon it, it was a decided failure in hot climates in consequence of the difficulty, under such circumstances, of getting the salt to penetrate into the meat before decomposition set in. Rapid decomposition in tropical climates was the great obstacle to the salting process, but in colder climates this did not exist. It was not, however, in temperatures like that of England that the salting process was greatly required; at the present time the meat was eaten almost faster than they could get it. He remembered, about twenty-two years ago, a process similar to that described in the paper was proposed, in which the antiseptic properties of nitrogen were made available, though in a different mode.

The meat was enclosed in an air-tight vessel, and the gradual absorption of the oxygen was effected by the previous deposition of a small piece of phosphorus at the top of the vessel, and this was not found to interfere with the quality of the meat. They had not been informed as to the cost of producing the nitrogen for this purpose: nothing had as yet been said as to the means employed for obtaining it, or the cost of it when obtained. That was not a minor consideration, because they were told that a double application of nitrogen was required, which involved a large consumption of that gas. If that process could be adopted in warm climates it would be much preferable to the use of saline matters. On the first introduction of preserved meats into France, in 1811, the Emperor Napoleon rewarded the inventor with a liberal premium or pension. For his own part he must say he infinitely preferred the meats preserved in tins to the charqui recently introduced, and he should particularly rejoice if, by means of curative processes, salmon could be obtained at 1s. per lb., instead of having to pay the present high price of 3s. 6d. per lb.

Mr. DAVIS called attention to two pieces of raw beef on the table which he said had been cured by Mr. Morgan's process in Adelaide, six months ago, at a time when the temperature was 85°, and had since been brought home in the hold of a wool ship, which every one knew was particularly hot. That process of injection, immediately after the animal was slaughtered, he apprehended might be safely adopted in the hottest climates.

Mr. JONES stated, in reply to the inquiry of Dr. Bachhoffner, that the cost of nitrogen gas did not exceed the eighth of a penny per lb. of meat. On a large scale it would be even less than that. In the first instance, he formed the binoxide of nitrogen from nitric acid and iron plates, and then produced the nitrogen gas by further decomposition.

The CHAIRMAN said he was sure the meeting would cordially join with him in according their best thanks to Mr. Steet for the very admirable manner in which he had introduced a subject of great importance in the present day, and which had elicited so interesting and practical a discussion. It was a subject which was occupying a large amount of public attention. The discussion had already lasted so long that at that late hour he would not trouble them even with the few observations he had intended to offer, but he would call upon them to give their thanks to Mr. Steet for his very valuable and interesting paper.

The vote of thanks was then passed.

Various specimens of preserved food were kindly contributed by the following gentlemen, to whom the thanks of the Society are due:—Messrs. M'Duncan, of Jersey—Cods, tongues, salmon, lobster, &c., in tin cases; Messrs. Hogarth—Roast and boiled meats, in tins; Messrs. E. Collier and Co.—Salted and dried fish, the "Boneta" and "snapper" from Spain, as well as preserved potatoes and compressed vegetables from Holland; Mr. Jones—Specimens of fresh meat, poultry, vegetables, and fruit, in glass cases, preserved by his process; Mr. Davis—Meat preserved in South Australia by Mr. Morgan's process.

Mr. W. Symons exhibited an ale-preserver, of which a description will be found at page 321.

At the conclusion of the meeting those present adjourned to the Society's library and partook of various dishes, prepared under the kind superintendence of Mr. Warriner, from the different sorts of preserved food above referred to.

Proceedings of Institutions.

LEEDS PHILOSOPHICAL AND LITERARY SOCIETY.—The report of the Council at the close of the forty-fourth session says that both as regards its financial and numerical position, the society is in a prosperous state. Seventy-six members and subscribers have been elected during the past session. In consequence, however, of several unusually heavy but unavoidable items of expenditure, trenching upon the ordinary funds, having occurred, the balance in favour of the society is not so large as at the close of the previous year. With regard to the expense of the alteration of the building, the amount received has been £11,128 15s. 8d., while the cost has been £11,515 13s. 11d., so that a deficiency of £386 18s. 3d. still remains against the society. The Council record the great loss which the society has sustained in the death of Mr. William Gott, who, from the first formation of the society, took the most lively interest in its advancement, and especially in the improvement of the museum, and was always ready with his purse to assist in the purchase of desirable objects. By the removal from Leeds of Mr. O'Callaghan the society lost the services of an active and valuable officer. During the last seven years Mr. O'Callaghan has been one of the honorary secretaries, and has devoted his entire time and energies for the benefit of the society. The papers read at the general meetings have been of a varied and highly interesting character. Among them may be mentioned one "On the Physical Constitution of the Sun," by Edward William Brayley, Esq., F.R.S., &c.; one "On Roger Bacon, his Life and Works," by Thomas Marshall, Esq., M.A.; one "On the Geology of the North of England," by Professor Robert Harkness, F.R.S., F.G.S., &c.; one "On the Sources of the Nile," by Dr. Charles T. Beke; one "On the Early Domestication of Animals," by Francis Galton, Esq., F.R.S., &c.; one "On the Unity of the Human Species," by George Rolleston, Esq., M.D., F.R.S., Professor of Anatomy in the University of Oxford; and one "On the history of Leeds before the Norman Conquest," by Thomas Wright, Esq. During the Christmas vacation two juvenile lectures "On the history and progress of the Electric Telegraph," were gratuitously delivered by Mr. Dodwell, of Manchester, with numerous illustrative experiments; and a course of four lectures was also delivered by Professor D. T. Ansted, on the following subjects:—"The influence of Water in forming Rocks;" "The influence of Water in modifying rocks;" "Granite, its origin and history;" "On the early races of Men, and their Contemporaries." The annual conversazione was attended by a very large number of the members and friends of the Society, on which occasion a great variety of objects of art and historical interest were exhibited. The receipts from this source have amounted to £149 10s. 5d. The museum continues to receive many valuable accessions by donations; and as an educational collection for illustrating the higher groups in zoology, is probably second to no provincial museum in the kingdom. Mr. Salt, of Methley-park, having most liberally offered to kill one of his finest specimens of alpaca, for the society's museum, the Council, while accepting the valuable present, considered that so good an opportunity for enabling the members to partake of the flesh of this only partially acclimatized animal should not be lost, accordingly a dinner was prepared at the Queen's Hotel, where about 60 gentlemen assembled, and the council had the pleasure of receiving Mr. Salt as their guest. The department of archæology has been more than ordinarily enriched by the acquisition of specimens of local and general importance. From the Rev. John Gott has been received a valuable series of Greek marbles, consisting of altars, mural tablets, and inscribed stones, collected in Athens and other Greek cities by the late Benjamin Gott, jun., Esq. The additions to the library have been of an important character. Since the last annual meeting a MS. catalogue has been prepared, by which it will be seen that it now contains about 2,000 volumes. Another addition has been made to the picture gallery, which was commenced last year, consisting of a fine oil painting by Ruysdael, presented by Mr. Arthur Lupton. The collection of British plants, which has

been annually increasing for a number of years, and arranged upon the Linnean system, has been considerably enhanced in value and usefulness through the kindness of the Rev. C. H. Middleton, who has devoted much time and labour to the complete examination and entire re-arrangement of the specimens upon the natural system. In the report for last session, the importance of establishing an Industrial Museum in connection with the Society's operations, was brought before the members, and a sub-committee was appointed to carry out the preliminary arrangements, and their labours have been so far successful as to promise a speedy opening of the room appropriated for the purpose. Various presents have been made to this museum, such as samples of the different seeds from which oils for commercial purposes are expressed, a case of colonial wools, various kinds of cochineal, specimens illustrating kelp and its products, and various kinds of sheet gelatine. Many specimens have been furnished from the South Kensington Museum, as well as between 300 and 400 glass jars, for containing specimens, also a complete set of printed tablets for describing a food collection. The committee have brought the objects and claims of the museum under the notice of Dr. J. Forbes Watson, of the India Museum, and they are much gratified at finding that this gentleman is anxious to extend the influence of the Department over which he presides by enlisting the services of industrial museums in the provinces in bringing before the manufacturing communities materials capable of industrial uses. Applications have been made to about 60 firms for specimens of the materials employed by them in various arts, and hardly a refusal has been received. The cash account, from May 6, 1863, to June 30, 1864, shows that the receipts have been £1,061 1s. 1½d., and that there is a considerable balance in hand.

NEWCASTLE-UPON-TYNE CHURCH OF ENGLAND INSTITUTE.—The eleventh annual report speaks of quiet prosperity and steady progress. The number of members has increased from 376 to 400 during the past year. One hundred and eighty-two volumes have been added to the library. The reading-room is well attended, and the circulation of books continues to be very large. The Council specially urge on the members the importance of using every effort to enlarge the sphere of its usefulness. The Soirée held on Whit-Tuesday, under the presidency of the Mayor of Newcastle, Thomas Hedley, Esq., was, as it always is, successful in a pecuniary point of view. The lectures were particularly interesting, the room having often been inconveniently crowded. Among the lectures given were one by Rev. J. J. Taylor, M.A., "A Ramble among the Ruins of Pompeii;" one by T. Austin, Esq., on "Monastic Life;" one by Rev. W. A. Scott, M.A., Incumbent of Seaham, on "The Catacombs of Rome;" one by Mr. G. J. Baguley, on "Painted Glass," illustrated by cartoons of ancient and modern examples; one by W. D. Crewdson, Esq., on "Iona—its History and Associations;" one by Archdeacon Priest, on "Palestine;" and one by the Rev. Canon Dykes, M.A., on "The History of English Church Music," illustrated by a choir. The classes are:—French, Singing, Phonography. The first is decidedly successful; the second, hardly so flourishing as might be expected; the third is conducted gratuitously, but is not very well attended. The free admission of elder scholars from Sunday-schools to the benefit of the Institute is still considered to be of great advantage to them. The librarian's salary has been increased, on account of the additional labour which the new arrangements have caused. The treasurer's account shows that the expenditure has been £314 3s. 1d., and that there is a balance due to the treasurer of £7 15s. 5d.

DUBLIN INTERNATIONAL EXHIBITION.

The colonial arrangements are making great progress, and accounts continue to arrive of very fine collections being on the way.

In Victoria a board has been formed, consisting of the following gentlemen:—Sir Redmond Barry, Chairman; Professor Mueller, Professor M'Coy; A. R. C. Selwyn, C. E. Bright, W. W. Wardell, and R. Brough Smyth, Esqs.; Mr. J. G. Knight being Secretary. An attractive series of products had been secured for transmission to Dublin. Among the contributions will be a choice collection of fleeces, selected from the stock exhibited at the recent great intercolonial show; samples of the new crop of cereals, contributed by the Board of Agriculture, and specimens of the manufactures of most of the claimants of Government premiums for "novel industries." Contributions of minerals, timber, fruit, tobacco, silk, flax, &c., are also promised. Application has been received by the executive committee for 1,500 superficial feet of floor space, to be reserved, for the productions of this colony. The goods were to be shipped by the Great Britain, which was to leave Melbourne on the 10th March. From New South Wales, New Zealand, Tasmania, and South Australia, collections are also expected.

In Mauritius a Committee has been appointed for the purpose of promoting in the island the design and intention of the Exhibition. The same sum has been voted by the Legislative Council (£250), upon the recommendation of the Governor, Sir H. Barkley, as on the occasion of the two International Exhibitions held in London, and on that of the Exposition held in Paris, to be applied as may be required for the promotion of the object in view. A fine collection of sugars, fibres, vanilla, tobacco, matting, and various other products, arrived overland by the last mail steamer at Southampton.

Jamaica, Dominica, Trinidad, and other West India colonies will be represented. Natal sends a small but interesting collection of produce and native curiosities and other articles.

There will be an interesting collection of products from the Hawaiian (or Sandwich) Islands; and among the other distinguished personages who will visit the Exhibition will be Queen Emma, her Hawaiian Majesty.

RURAL COTTAGES.

By G. H. WALKER, Esq.

As the attention of the Society of Arts, and of many persons throughout the country, is now most usefully turned to the means available for improving the dwellings of the labouring classes, I am desirous of adding my mite to the common stock of information on the subject.

I find a general impression prevailing—an impression confirmed by, if not derived from, the various designs and estimates of costs that have been from time to time published—that good durable rural cottages, with two or three bedrooms, must necessarily cost something like £150 a-piece, a sum for which labourers cannot pay adequate interest in the shape of rent.

I think this impression is erroneous, and that it seriously obstructs the good work which it is now one of the objects of the Society of Arts to promote; and I think I shall be able to show that such cottages may be constructed, in a throughly satisfactory manner, with all usual and necessary appurtenances, for £80 or £85.

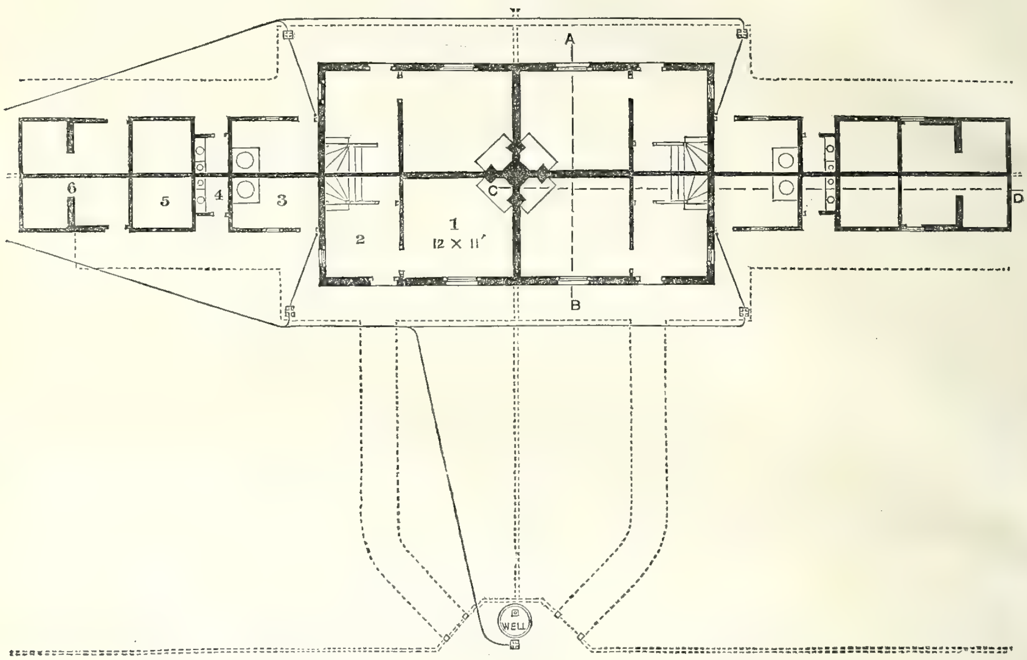
Ten years ago I built, near Rugby, for £70 a-piece, the four cottages in one block, of which plans and sections are given above. They are built of brick, slate, blue lias lime, and good foreign timber, and well drained and spouted; with a layer of slate in the walls to prevent damp rising above the foundations. They have each a wash-house, pigsty, &c., and the block is supplied with a pump and well, and the total cost of the four dwellings—including everything but the value of the land—was £280, or just £70 a-piece. As I employed no architect, and had the cottages built by a working mason of sufficient ability, on contract, there was no addition to the actual cost of con-

struction. However, I am authorised by a builder of the highest respectability, Mr. John Bromwich, of Rugby, to say that he is prepared to build similar cottages, under similar (that is, I believe, average) circumstances, by the dozen, at £80 a-piece. There was no undue favour given to these cottages; though the bricks, lime, and sand came from the estate, they were charged the full market price, and had to be hauled a mile over bad parish roads.

The economy of these cottages consists in their extreme simplicity; in there being four together, back to back and side by side, with one stack of chimneys for the eight flues, one for each principal room of each cottage.

I am aware that there is a general idea that cottages built back to back are not healthy. In large towns, and under certain circumstance, this may be so, but in the country, with two sides of the cottage open to

FIG. 1.—GROUND PLAN.



1. Living room. 2. Ante room. 3. Washhouse. 4. Closet. 5. Dust bin. 6. Pigsty.

FIG. 2.—CHAMBER FLOOR.

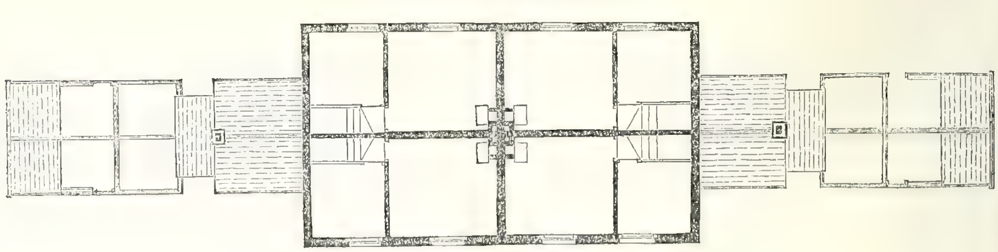


FIG. 3.—ELEVATION.

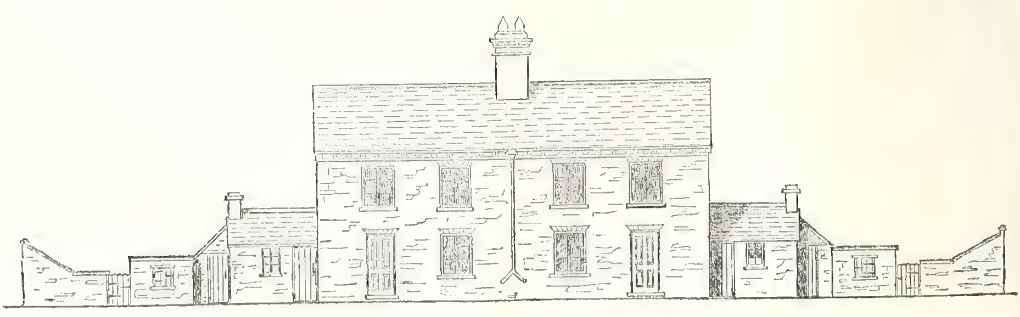
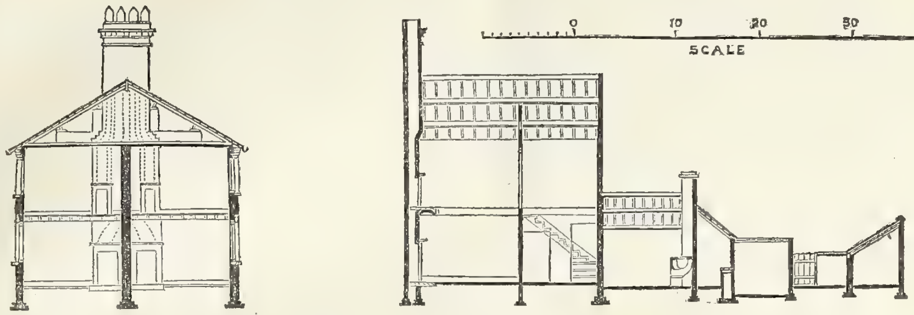


Fig. 4.—Longitudinal and Cross Sections.



the air, I am convinced that it is needless to incur considerable additional expense by rejecting this arrangement. These cottages have never been objected to by tenants or visitors, and an inspection of them would show that a cottage thus built may be as sweet, wholesome, and comfortable as one that has a thorough draft from back to front—probably much more so. We do not know how much discomfort and sickness are produced in small cottages by that "thorough draft" when the doors are ill-fitting or frequently open. The fireplace in the angle of the living room, and thus radiating into all parts of the apartment, is found very conducive to comfort and economy of space.

It will be seen, by an inspection of the plan, that by a trifling expenditure—say £5—in a porch, with oblique doorways into the "living room" and the room adjoining, (with some change in the position of the staircase) the latter may be converted into a third bedroom.

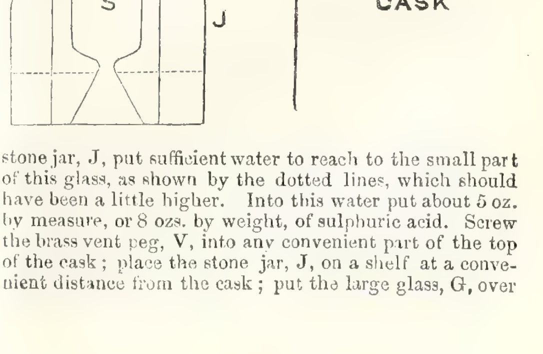
These cottages let readily at 2s. a week, a sum that agricultural labourers getting 12s. or 13s. can afford to pay; and that rent yields an interest on the £70 of about 7½ per cent., subject to deductions which certainly leave a good 6 per cent. I may mention that these have been very favourite cottages, and from the first not one has been left by a tenant willingly. They have hitherto, after ten years' occupation, hardly cost anything for repairs, nor do I believe that they will do so for 50 years to come if they receive ordinary care and attention at the hands of the occupants.

I have mentioned that the value of the land is not included in the cost: but as only about one-hundredth part of an acre is covered by each cottage (or a tenth if the garden be included) it is hardly necessary to take it into account. Land in rural districts may be laid at its agricultural value, say £2 an acre, so that the cottage would occupy land worth 5d., and the cottage and garden land worth 4s. per annum. As a general rule land used for cottage building need not be debited to their account by landowners, for the additional value given by them to the adjoining ground for gardening purposes more than compensates for the land occupied by the buildings themselves.

Of course the above design and calculations only apply to rural districts, but it is there that the greatest difficulties are generally felt, because of the very low wages of the rural peasantry. In towns, where land is much dearer, and building is so to some extent, the earnings of the labouring classes are larger to a much greater degree; and when six or seven shillings a week are readily paid for the narrowest accommodation there should be no difficulty in providing plenty of dwellings at amply remunerative rates. Of course the arrangement and style of building must be totally different from those of rural cottages, but while in many respects they must be more expensive in some important particulars, they may be more economically constructed. Upon the whole the balance of advantage financially must be with the town; it must be less difficult to make the income cover the expense there than in the country.

ALE PRESERVER.

The following is a description of an instrument invented by Mr. W. Symons, F.C.S.:—Ale and beer when on draught is rendered flat and sour by means of the air which must enter the cask as the liquor is drawn off, and this will be the case whatever contrivance (as patent vent pegs, syphon taps, &c.) are used. The place of the liquid must be supplied, or the tap will not run, and the atmosphere must always have an injurious effect on the quality of the ale or other liquor. In this apparatus, while the ale can be drawn with the greatest freedom, the air is perfectly excluded, and carbonic acid gas supplied in its place. As there is thus no free oxygen allowed to enter the cask, no acidifying from this cause can take place, and the bad effects of an ill-ventilated cellar are also prevented. It is well known that the superior quality of bottled ale and stout depends on the carbonic acid gas said to be contained in it, which is set at liberty when the cork is removed, and thus the effervescence is produced. By supplying carbonic acid instead of air to the cask a portion of it is dissolved in the ale, which imparts to it some degree of the briskness of bottled ale, in addition to keeping it from turning sour. To use the apparatus for a 9 gallon cask, put 1lb. of common washing soda in small lumps into the inside glass S; in the



stone jar, J, put sufficient water to reach to the small part of this glass, as shown by the dotted lines, which should have been a little higher. Into this water put about 5 oz. by measure, or 8 ozs. by weight, of sulphuric acid. Screw the brass vent peg, V, into any convenient part of the top of the cask; place the stone jar, J, on a shelf at a convenient distance from the cask; put the large glass, G, over

the one containing the soda, both of the glasses being in the acid and water; attach the apparatus to the vent peg, V, by the India rubber tube, T, and it will require no more alteration until the cask is empty, unless the weather be very warm and dry, when a little water may be required to allow for evaporation. When ale is drawn from the tap the acid and water in the jar J will rise into the glass, S, and on reaching the soda effervescence will take place, and as sufficient carbonic acid is disengaged, the water will sink to its usual level, thus removing the acid from the soda until more ale is drawn. If the water does not rise in the glass, S, when ale is drawn, it shows the cask is not properly stopped at the bung or elsewhere, thus giving an indication the cask is not as it should be. As sulphuric acid can be easily procured in quantities of 6lbs. or so at about 3d. per lb., the working expense will be less than 3d. for a cask of nine gallons, and persons who have gardens may utilize the waste product by adding it to the manure heap.

Fine Arts.

Encouragement of Art in France.—The annual exposé of the situation of the empire contains a long list of works of art purchased, and of public monuments created, restored, or beautified at the cost of the Government. In painting, the most important commissions executed or commenced during the past year were:—The decoration of the Grand Court of the Invalides, the walls and vaults of which are being covered with subjects drawn from the most memorable periods of French history; of the Chapel of the Senate; of a portion of the Cathedral of Agen, and of many chapels in Paris. The Galleries of Versailles and the Luxembourg have received a number of historical portraits and other works. The Polytechnic School and the Hotel of the Minister of War have been presented with portraits of celebrated savans educated at the former establishment, and of military celebrities. The decorations now being executed at the Museum of Amiens have been aided by a grant from the public purse, and that and other provincial galleries, prefectures, sub-prefectures, and mairies have had a large number of original pictures and copies presented to them. The commissions to sculptors and purchase of sculpture have been numerous. Amongst others may be mentioned statues of the Empress Josephine, for Versailles; of Vaucanson, for the Conservatoire des Arts et Metiers; of Baron Desgenettes for the Imperial Academy of Medicine; a number of historical figures for the niches of the Old Louvre, and a number of busts of celebrated men for the Louvre, Versailles, and the libraries of the Institut and of the Conservatoire Imperial de Musique. A bust in marble of Jacquart has been presented to the town of Roubaix; one of Bayard to Grenoble; and a portrait of a prelate, native of the town, to Tours. A statue of Gaston Phœbus was presented to the town of Pau; and the State has subscribed towards the following monuments:—That of Marshal Davoust, at Auxerre; of Mezeray, at Argentan; of Jean de Rotrou, at Dreux; of General Pajol, at Besançon; of Dom Calmet, at Commercy; and several others. A very important work achieved during the year was the reproduction, by the galvano-plastic process, of the bas-reliefs of the Trajan column, now exhibited in the New Louvre, and which have been noticed before in the *Journal*. Another was the restoration of the statue of Napoleon, after the original design, on the Colonne de la Grande Armée in the Place Vendome. A statue of the present Emperor is now in hand, destined to record the annexation of Savoy and Nice to France.

International Fine Art Exhibition at Amsterdam.—In addition to the exhibition to be held in the New Crystal Palace at Amsterdam, another for the works of art of all nations is announced to open on the 4th of September next, and to remain so until the 9th of October, or later, if the committee see fit. The managers of the undertaking pay the cost of conveyance by the ordinary luggage trains, but the exhibitors have to bear the expense of the return of their works. The last day for their reception is the 4th of August. Six gold medals, of the value of one hundred florins each, are mentioned as prizes, but no others.

Manufactures.

Steam Roller.—A huge machine for crushing and consolidating the broken stone on the macadamised roads of Paris, has lately been tried in one of the great new boulevards, and in other places, and it is reported with a satisfactory result. The new steam roller consists, in the first place, of two very large cast-iron rollers, which are coupled together by means of two endless chains acting on rachet-wheels attached to one side of each of the rollers, the boiler being placed over one of the rollers and the cylinders nearly in the centre between the two. The axles of the two rollers are so arranged that they may be thrown out of parallelism, and thus enable the machine to turn round with a circle of about five-and-forty feet diameter. The whole machine weighs seventeen tons, which is more than double the weight of the largest roller heretofore employed, and it is said that the economy amounts to 60 per cent. as compared with the old method.

Swiss Watchmakers.—Mr. John Bennett, in a lecture entitled "A month among the Swiss watchmakers," draws attention to the fact that from England we are sending a million pounds sterling a year to the people of Switzerland for watches for home consumption. He had determined to learn what were the causes of this superiority on the part of our Swiss rivals. He had found that they had a better system. They had a common standard of measurement decimalised; they had far better tools; and they knew the value of female labour. But at the root of all their superiority lay their admirable system of universal education. To this most especially must be attributed their extraordinary success. The Swiss eighty years ago made but 2,000 watches; fifty years ago they made 8,000; but ten years since one million and a-half of watches were made in the district of Neufchatel alone. Their leading men, years ago, were wise enough to perceive that the only way to produce perfect watches was first to perfect the workmen. They declared that ignorance was a pest in any community, and even a criminal offence; they established by law the means of education in every village; they declared that education should be gratuitous, but also compulsory and universal; and from time to time since those regulations were first put into force they have never failed to apply all the powers of later experience to the improvement of their educational system. Hence the superiority in the broad silks of Zurich—in the lovely ribbons of Basle—in the exquisitely plaited straw of Lucerne—in the articles of personal decoration of Geneva—in the rifles of Mudon—and in the watchwork of the Jura mountains. The cultivated intelligence and artistic taste of the people of this busy hive of industry produce watches in tens of thousands, of a character, for external beauty of form and decoration, for precision of mechanical construction, and for cheapness of cost, which has forced their sale in every quarter of the globe. Mr. Bennett gave an instance of the importance the Swiss attach to the most improved system that can be applied to the purpose of popular instruction. About ten years ago the village of La Chaux des Fondes, occupied almost entirely with watchmakers, and situate at the highest summit of the Jura mountains, was dissatisfied with its educational institutions. They had secondary schools, primary schools, normal schools, for the preparation of teachers, and during the winter, when perhaps the snow was lying six feet deep

on the ground, they had half-a-dozen schools spread round the suburbs, so that half the masters went to the scholars when the scholars, from the state of the weather, could not come to the masters; and yet the system was not considered sufficiently complete to ensure the future success of the rising generation of workmen. The watchmakers met. They got plans for a new college to accommodate 1,000 scholars; they obtained a grant of £7,000 from the Federal council; they subscribed £5,000 amongst themselves; they built a college at the cost of £20,000, and raised the balance of £8,000 on the security of their local taxes. Hence the superiority of this most remarkable people, hence their welfare and prosperity, and hence, too (said Mr. Bennett), if we did but know it, a striking example which we may wisely take as a model for the improvement of our own social, intellectual, and political condition.

Micagraphie.—This is the name given to a new process of producing ornamental effects on sheets of mica. The facility with which this mineral cleaves into thin sheets, and its transparency when thus divided, are well-known, and we see it applied in cases where transparency and a high power of refraction are required, such as in the doors of stoves and other similar positions; and attempts have been made to apply it to the manufacture of chimneys for lamps and gas burners, but with little success. M. Holthausen's new application is beginning to find its way into the shop windows of Paris, and to attract attention. He prints his designs on the mica in grey, and afterwards produces his effects by the use of transparent and opaque colours and metallic reflections. The use made of this new process has been as yet confined to the ornamentation of lamps and shop windows, but it is proposed to apply it to the production of a cheap substitute for stained glass. The sheets of mica can be painted in any required manner, and the work preserved, it is said, by means of a varnish, or the painting may be fixed like enamel on the mica by the use of different pigments and the aid of a furnace, the pieces of painted mica being afterwards fixed, with the coloured side within, on the glass of the windows. The mode of proceeding is thus described:—After the mica is split into laminæ and trimmed into shape it is glued down upon cardboard to be polished and printed. The former operation is performed by means of a soft rubber moistened with a solution of soap or sulphuric acid extremely diluted with gum-water; the printing is performed in the ordinary manner or by transfer, in order to present the design in the natural position so as to be seen by transparency. Opaqueness is produced by a previous coat of varnish or a metallic ground obtained by means of leaf or powder. The colours are laid on as in illuminated works, and the ordinary pigments may be employed, and afterwards covered with a transparent spirit varnish; or, as before stated, enamel colours may be used and the sheets passed through the fire. It is admitted, however, that in the latter case one great advantage of the process, namely, cheapness, is in a great measure sacrificed. When the ornamentation is completed the mica is removed from the card and fixed on glass, or any other substance, by means of a solution of gum sandrac, and mastic, in potash and alcohol. It is said that, with ordinary care, the junction of the pieces of mica in a mosaic or other work is quite imperceptible, so that, in the case of a painted window, there is no other limit but the size of the glass on which the mica is fixed. Whether church windows will ever be executed in micagraphy may be open to much question, but the use of mica as an inexpensive means of ornamentation may be very acceptable.

Commerce.

French Life-boat Association.—The English association for the saving of life from shipwreck has always been looked upon with great admiration in France. There exist in most of the French seaports, local associations for the same benevolent purpose, but they are crippled in their means, and have no organisation among themselves. M. Th. Gudin, the marine painter, whose brother was lost at sea, has long striven to establish a central association in France on the plan of the English society, and the Imperial Government has authorised him to proceed with the good work. A number of admirals, captains of the navy, and rich ship owners, have become patrons of the new association, and Baron de Rothschild and M. Donon have undertaken the care of the funds, and M. Delvigne, the inventor of the porte-amarres, or life-line, is named secretary. The carrying out of this desirable object may be attributed in a very great degree to the excellent articles by M. Alphonse Esquiros on the life-boats and other means of saving life in use on the coasts of the United Kingdom.

Colonies.

Land in Victoria.—A return laid before the colonial Legislative Assembly shows that there are in Victoria 1,156 pastoral runs, occupying, at the time of the passing of the Duffy Land Act, an area of 31,785,468 acres, and producing a rental of £225,113 17s. 7d., or an average of little more than 1½d. per acre. As many as 89 runs, occupying an area of 6,277,340 acres, produce less than ¼d. per acre. Since 1862, 364 of these runs have been transferred, and 1,311,469 acres embraced in them have been alienated. As many as 70 runs, extending over 3,748,593 acres, have been forfeited under the provisions of the Land Act of 1862. In addition to the above, there are 16 runs, occupying 345,604 acres, the arrear rent of which has not been satisfactorily determined. The number of licenses issued to pastoral tenants for grazing purposes during the past year is 1,172, the number of persons to whom the same have been issued is 737, and the extent of land held under such licenses for grazing purposes is 30,722,886 acres.

Australian Companies.—A prospectus of a new company, called the Pastoral Loan Company of Australia, has been issued. The objects of this company are to make advances on all descriptions of pastoral property in the Australian colonies, and also to purchase and sell such property if necessary, and to carry on all kinds of mercantile operations and agency incidental to such business. The capital is £250,000, in 25,000 shares of £10 each. The provisional committee comprises the names of several influential gentlemen connected with mercantile and pastoral pursuits, who are prepared to take up 10,000 shares. A prospectus of a new steam company, called the Clarence River New Steam Navigation Company, has also been issued. The capital is £30,000, in 6,000 shares of £5 each. Three-fourths of the shares are to be reserved for allotment amongst the inhabitants of the Clarence and Richmond and New England districts.

New Zealand Railway from Dunedin to Port Chalmers.—It appears from the Otago papers that the provincial Government have received overtures for the formation in England of a company for the construction of this railway. There is a strong probability that the company will be formed.

New Zealand Gold.—The gold-fields of the province are progressing most satisfactorily. From the Upper and Lower Buller the accounts are of a very encouraging description; and although there have not been any large finds, the men are all satisfied with the returns. From the Grey the last accounts were also favourable, the steamer *Nelson* having brought up nearly 700 ounces, most of which was purchased in a week.

New Zealand Coal.—The coal beds at Motupip which for some time have lain neglected, are again abou to be turned to account, operations having been com-

menced there. Instead of seeking to procure coal of inferior quality, obtained at or near the surface, an effort has been made, by deeper workings, to reach the coal in a more compact and pure state, and it is satisfactory to find that this has been attended with very great success. It is the intention of the lessees of the Motupipi coal-field to ship coal regularly to Nelson and sell it at a price which will enable them to compete successfully with coal from Australia. This coal has been successfully tried for steam purposes. The consumption is rather greater than that of Newcastle coal, but as the price of this coal is only about two-thirds that of Newcastle coal, it is more economical, while it otherwise answers exceedingly well. No difficulty has been found in getting up steam with it.

Steamers in South Australia.— There has been launched a new steamer, owned by the Murray River Steam Navigation Company, being the first of a line of steamers intended to ply on the Murray and its tributaries. It is built on the iron and wood principle combined, having an angle iron for the timbers, and Oregon pine for planking, which makes very strong and substantial work, is much lighter and neater than wood framing, thus securing a much greater degree of safety to a cargo, for if one of the compartments were to get filled with water, the vessel would still float, with no damage to the goods in the other compartments. Both engines and boiler were manufactured in Melbourne, and are said to be of first class workmanship. The dimensions are, length, 85 feet, beam, 15 feet, and she is expected to be a very fast boat. The company intend building other vessels of light draught and great speed.

Obituary.

Robert Lucas Chance, sen., of Summerfield, Birmingham, died on Tuesday, the 7th March, at Northfleet House, near Gravesend, in his eighty-third year. Mr. Chance belonged to one of the oldest and best-known families engaged in trade at Birmingham, where he was originally in business, with his father and brothers, as factors. Afterwards he came to London, and established himself in the glass trade; but, returning to Birmingham thirty years ago, he has ever since been closely identified with the rise and success of the great firm of Chance Brothers and Co., at Spon-lane, in which, up to his death, he was the senior partner. It was to his remarkable ability, far-sighted enterprise, sound judgment, and unwearied industry, that the progress of that house is greatly due. In 1851 it was owing to his firm that the glass for the erection of the Exhibition building was produced. At that time there was no firm existing in this conntry capable of producing the glass of the size and weight required under the contract, within the time specified, and had it not been for his capital and enterprising spirit, the work could not have been carried out. The microscopist is indebted to him for the thin glass for mounting his objects, and he did much for the improvement of glass for optical purposes, as well as for the large construction of lighthouse lenses, in which he competed successfully with the French manufacturers. Partly on account of deafness, and partly from his habit of mind, Mr. Chance avoided all public business. But there was one great duty which few men have more thoroughly or unostentatiously discharged; on a settled principle of benevolence, and as a point of conscience, he acted rather as the steward than as the owner of his well-earned wealth. His public munificence, great as it was, relatively bore a small proportion to his private beneficence. He possessed a keen insight into the questions which from time to time have occupied the attention of cultivated men. He had read much and thought deeply; and, gifted with wonderful energy of mind, seasoned with a shrewd though kindly humour, he had a way of expressing his opinions which impressed them with singular force upon the memories of his auditors. In all that had relation to politics and religion, Mr. Chance was broadly Liberal, in the best sense of the word. Though not a member of the Church of England, he was entirely free from sectarian bitterness, and always spoke of the Church and of Churchmen with the greatest respect. As one of the founders and warmest supporters of the Edgbaston Proprietary School, he illustrated by his conduct his settled conviction that religious and secular education should be entirely separated.

The death of Sir Robert Hermann Schomburgk, the eminent traveller, took place at Berlin on the 11th inst. Sir Robert was born in 1804. In the years 1835 to 1839 he undertook expeditions in British Guiana, under the auspices of the Geographical Society of London; and in the years 1840 to 1844 extended these explorations as Her Majesty's Commissioner for surveying the boundaries of British Guiana, between Brazil and Venezuela. On this occasion, after enduring much fatigue and great privations, with his small party, he completed the circuit of the colony, from its sea boundary to within forty-two miles of the equator, in the course of about three years. For these labours he was knighted by Her Majesty. During his expedition he discovered and introduced into Europe the well-known water lily the *Victoria regia*, which he assumed for his crest. Sir Robert was also made a Knight of the Royal Prussian order of the Red Eagle, of the Royal Saxon Order of Merit, of the French Legion of Honor and a corresponding member of the Royal Geographical, Zoological, and Entomological Societies of London, and of many foreign scientific societies. He was a frequent contributor to the leading scientific periodicals of the day, and to the proceedings of the British Association; and among other of his published works may be mentioned "A Description of British Guiana," "The History of Barbados," "Views in the Interior of Guiana," and "Reisen in British Guiana in der Jahren, 1840-44." Sir Robert filled the posts of British Consul General in San Domingo and Siam, and he only returned from Bangkok at the close of last year. His funeral was attended by a large number of scientific men.

Notes.

Statistics of Paris.—The population of Paris at the end of 1863, according to the *Annuaire* of the *Bureau des Longitudes* for 1865, numbered 1,667,841, or, with the garrison, 1,969,141. The excess of births over deaths was 11,495. The number of marriages 16,485. The births numbered 54,077, viz., 27,634 males, and 26,443 females; of this number 6,262 were born in the various hospitals, and 15,239 were illegitimate, of which number, 3,708 were recognized by the parents, according to the law in force in France. Of the 42,582 deaths, 10,975 occurred in the civil, and 647 in the military hospitals, and 114 in prison. The number taken to the Morgue was 346, of which 61 were not recognized, or not claimed by their family or friends. It is a curious fact that the number of deaths from small pox was just ten more than that of the suicides and accidents recorded at the Morgue. In the whole of France there were just over a million of births during the year, of which 76,697 were illegitimate. The excess of births over deaths was 138,481 only. The Parisians consumed during the year about sixty millions of gallons of wine, something less than an average of a pint per head daily, and nearly eight millions of gallons of beer; 333,342 tons of butchers' meat, 1,784 of charcuterie, sausages, and other compounds of the same class; nearly 183 tons of pâtés, small shell fish, truffles, &c.; 2,969 tons of cheese; oysters to the value of £106,000 odd; fish to the extent of £475,427; poultry and game equal to £871,769; butter representing nearly a million and a

quarter sterling; and eggs more than half that sum. They burned 629,863 tons of coal, coke, and carbonized peat, and upwards of 13,000,000 bushels of charcoal. They used nearly 6,746 tons of ice; and 11,386 tons of salt, white and gray.

A People's Park in Paris.—One of the rudest spots in the environs of Paris, the Buttes Chaumont, where for hundreds of years the quarries for the plaster of Paris have been worked, is being converted into a public garden and promenade. The new park will cover about sixty acres of ground, and the total cost, including the indemnities, will amount, it is said, to about £300,000.

Scientific Association of Paris.—This new society, headed by the Imperial Astronomer, exhibits great energy; it commenced by the application of a sum equal to £2,000, for the construction of large astronomical instruments for observations in the provinces; next it devoted £320 to prizes for meteorological studies; and it has just authorised a committee of its council to draw up a scheme for the employment of a sum of £240 in the encouragement of physical science. The committee has made its report, which has been adopted by the council. The sum of a thousand francs is devoted to an inquiry, to be made by M. Cazin, professor in the Lycée of Versailles, into the dynamic theory of heat. Another sum of 700 francs is to be placed at the disposal of M. A. Terquem, of Metz, for the apparatus necessary to work out his theory of the vibrations of plates, rods, and cords; the apparatus to remain the property of the association. A third sum of 500 francs is devoted to the purchase of a spectroscope; and a collection of crystals, prisms, and lenses, to be placed at the disposition of M. Gernez, of Dijon, for examination into the rotatory power of quartz in high temperatures. Two further sums, each of 500 francs, are to be given to M. Gaugain and M. Diacon, to assist those gentlemen in their researches in electricity and the spectrum analysis. It is hoped that next year the association will be able greatly to extend its operations.

Correspondence.

New Roots to Old Trees.—Sir,—The paragraph in the last *Journal* on the removal of old fruit trees, by which it appears that a French horticulturist puts a new tree to the old roots, reminds me of a plan rewarded by this Society in 1843, by which Mr. John Common put new roots to old trees. It is described in volume 55 of the Society's Transactions, p. 3, as follows:—"The plan of putting new roots on trees, and taking away all the old ones, is of great utility, for I know by experience that trees are often engrafted on, which, on account of their roots, will not allow the trees to bear the proper quantity of fruit; and the plan of putting new branches on espalier or wall-trees is also of great utility, as a branch is often wanted to finish the tree. This method of engrafting may be done at any time between April and August, and either with the present year's wood or with wood of several years' growth. The mode of effecting the addition of a branch to some particular part of the stem is by bending a branch either from the same tree or from some tree near to it, and inserting the end thereof behind the bark, which is properly cut to receive it, and then tying it carefully round with string, and it is more certain of taking hold or growing than by any other way of engrafting or budding, and as certain, or more certain, than by any other way of inarching. . . . . The mode of procedure in this novel operation, if the tree be small, is to plant a small tree close to it, inarching it as already mentioned, by bending it over to the original tree, and tying it round as before. The planting of the new tree should be done in the spring, before the year in which the inarching is performed; and when from sufficient growth it has firmly taken hold the old root may be taken away. If the tree to be underpinned be of large size, then several small roots are to be planted around it, and each inarched, as already mentioned. When the new roots have strength to carry the tree, the old ones must be taken away by degrees, care being taken to make an incision all round the bark."—I am, &c., Memor.

Cheap Restaurants in Paris.—Sir,—These institutions continue to flourish in Paris. Being lately in that city I visited one several times. A capital breakfast can be had for 6d. or 8d.; a cutlet and wine for 6½d. The places are tastefully decorated and clean. The attendance is given by a set of modest-looking women dressed like nuns, and altogether a luncheon in one of these establishments may well be recommended to every tourist, and he will not forget it. There are about a dozen of them in Paris, all thriving I believe. I enclose a specimen of the card which every one fills up.—I am, &c., Felix Summerly.

DUVAL.

Boucheries.
Rue Tronchet, 13.
Rue Coquillière, 15.

Etablissements de Bouillon.
Rue Montesquieu, 6.
Boulevart St. Martin, 13.
Boulevt. Sebastopol, 125 à l'angle du Bt. St. Denis
Rue de Rivoli, 47.
Rue Montmartre, 143.
R. des Filles St. Thomas, 7.
Rue de la Monnaie, 21.
Rue Sartine, 10.
Rue Beauregard, 2.

Les pour-boire sont facultatifs, nul ne doit les demander.

En cas de réclamations, s'adresser au Comptoir.

CARTE
de
PERSONNES.

05c. Serviette		
10c. Pain...		
80c. Huitres		
15c. Vin, le carafon		
15c. Eau de Seltz		
15c. Bouillon		
20c. Potages		
25c. Jambon ou Bœuf		
35c. B. V. M. Rotis		
20c. Legumes...		
30c. Macaroni		
25c. Salades		
15c. Desserts		
20c. id. dessert		
30c. Legumes, Fruits, Primeurs.		
30c. Café au lait, Café et petit verre		
30c. Glaces pour dessert		
35c. Canette, 20c. chope, Bière...		
15c., 20c., et 25c. Liqueurs... ...		
35c. Cotelette, Omelette ordinaire		
50c. Poisson, Gibier, Volaille ...		
50c. Bifteck ou Fricandeau... ...		

	VINS.	Bout.	demies.
Rouge et Blanc.	80c. Ordinaire		
	1f. Macon		
	1f. Bordeaux		
	1f. Chablis		
	1f. 50c. Bordeaux supr.		
	1f. 50c. Thorins		
	1f. 50c. Sauterne ...		
	2f. Medoc		
	3f. St. Julien		
	4f. 50c. Champagne ...		

Timbre du Jour.	Serie.	No.	Total.

Laissez cette Carte au Controle.

P.S.—Can any one say how the Soup Kitchens in this country are getting on?

MEETINGS FOR THE ENSUING WEEK.

Mon. ...R. Geographical, 8½. 1. North Polar Exploration; Second Letter of Dr. Petermann to Sir R. I. Murchison. 2. Capt. R. V. Hamilton, R.N., "Coast of Labrador." 3. Mr. R. MacFarlane, "Account of the Mackenzie River District."
Actuaries, 7. 1. Mr. A. Day, "On the Statistics of Second Marriages among the Families of the Peerage." 2. Mr. M. N. Adler, "On the Government Insurance Rates and Regulations."

Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Discussion upon "Drainage of Paris" and "Metropolitan System of Drainage."
Zoological, 8½.
Royal Inst., 3. Prof. Masson, "On Recent British Philosophy."

Wed. ...Society of Arts, 8. Mr. John Bell, "On Window Horticulture, and the Cultivation of Plants and Flowers in Cities and Crowded Localities."

Thurs...Royal Inst., 4. Mr. Charles Newton, "On Recent Acquisitions to the British Museum, from Rhodes, &c."
Royal, 8½.
Antiquaries, 8.
Chemical, 8. Annual Meeting.
R. Society Club, 6.

Fri. ......Royal Inst., 8. Mr. James Glaisher, F.R.S., "On Aerial Researches."

Sat. ......Royal Inst., 3. Prof. Marshall, "On the Nervous System."

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 28th February, 1865.*

78. Court of Chancery—Return.
84. Charities—Return.
87. Malt and Barley—Returns.
97. Local Government Act (1858)—Return.
98. Courts, Offices, and Buildings—Returns.
99. Duchy of Cornwall—Account.

Delivered on 8th March, 1865.

52. Bill—Partnership Amendment.
52 (I.) Trade and Navigation Accounts (31st January, 1865).
56. Weights and Measures (Metropolis)—Returns.
63. Menai and Conway Bridges—Return.
83. Thames Embankment—Correspondence.
89. Malt Houses, &c.—Returns.
101. Army Estimates (Extra Receipts).
103. Poor Relief—Return.
105. Revenue and Debt (Ireland)—Return.
109. Private Bills—Rules.

Delivered on 9th March, 1865.

51. Bills—Colonial Naval Defence.
53. ,, Union Officers (Ireland) Superannuation.
3 (228 to 249). Railway and Canal, &c. Bills—Board of Trade Reports, Parts 228 to 249.
43. Revenue Department—Accounts.
85. Corporal Punishment—Returns.
104. Private Bill Costs Bill—Minute of Proceedings.
Japan (No. 3)—Further Papers respecting the Murder of Major Baldwin and Lieut. Bird.

Delivered on 10th March, 1865.

23. Bills—Justices of the Peace Procedure.
55. ,, Public Offices (Site and Approaches).
56. ,, India Offices (,, ,,).
57. ,, Sheep and Cattle.
95. Doe Park and Bradford Reservoirs—Correspondence.
96. Fines and Penalties (Ireland)—Abstract of Accounts.
105. Pollution of Rivers (Sewage)—Memorials and Petitions.

Session 1864.

526. Tariffs—Return.

Patents.

From Commissioners of Patents Journal, March 17th.

Grants of Provisional Protection.

Bed tables, portable—525—C. J. Rowe.
Biscuits, apparatus for baking—555—G. T. Ellwick.
Bituminous substances, apparatus in distilling—571—J. Young.
Blast furnaces, preparation of iron ores for use in—534—F. Claudet.
Breech-loading guns, cartridges for—518—C. W. Lancaster.
Bridges, &c., beams and supports applicable to the building of—578—W. E. Kochs.
Coal oil, converting into gas—528—J. Nicholas.
Cotton gins—531—E. P. H. Gondouin.
Counters, shop and other—567—S. Whiting.
Crinoline skirts—529—J. Badcock.
Defence, key and weapon of—552—R. A. Brooman.
Eggs and fruit, jars for preserving—546—G. K. Geyelin.
Electro magnets—22—W. Clark.
Engines, hydraulic-pumps in connection with—521—W. Oram.
Explosive compounds—515—A. Meyer and M. Meyer.
Fancy articles, means for holding, attaching—505—W. Westbury and T. Wathen.
Fertilizing compounds—512—W. E. Newton.
Fire arms, breech loading—506—W. H. Aubin.
Fire arms, cap carriers for—519—H. E. Clifton, S. Myers, and A. Hoffnung.
Floor cloth, manufacture of—548—M. B. Nairn.
Fluid valve—547—C. Ching.
Furnaces, hot blast—2969—M. A. F. Mennons.
Gaiters, &c.—569—J. B. Toussaint.
Grain, &c., means of decorticating—561—W. Clark.
Heat or cold, composition for prevention the radiation of—2748—A. Estourneaux and L. Beauchamp.
Heat, apparatus for generating—516—J. Jacob and R. Pilzinger.
Horses, shoes for—3248—H. A. Bonneville.
Hydraulic presses—417—G. Whitton.
Hydro-carbon oils, treating—564—J. Fordred.
Locks and bolts—570—S. Whitfield.
Machinery, reaping—576—N. Henwood.
Mirrors, manufacture of—554—G. Haseltine.
Musical instruments—579—A. T. Godfrey
Organs and harmoniums—541—R. Smith.
Paper, manufacture of—532—T. Routledge and T. Richardson.
Paper, apparatus for cutting—557—M. Mason.
Ploughing, steam engines applicable to—522—J. Howard.
Pottery, earthenware, &c., manufacture of—453—W. E. Gedge.
Railway trains, signalling between passengers and guard or driver—504—G. Sinclair.
Railway carriages, buffers for—513—W. Rowe.
Railway chairs, &c.—544—H. H. Henson.
Railway wheels, presses for blocking tires of—573—W. Holiday.
Railway spikes, machine for pointing—575—M. Bayliss.
Railways, permanent way and rolling stock of—520—J. K. Donald.
Railways, signalling on—539—W. Calvert.
Safes, fire and thief proof—543—W. H. Tucker.
Safes, doors of—559—J. M. Hart.
Safes, fastenings for—507—S. Whitfield.
Safes, manufacture of—508—W. S. Mappin.
Safes, protection of property contained in—514—H. K. Taylor.
Scissors, &c., manufacture of—373—C. Lingard.
Screws, dies for cutting—565—G. Weigmann.
Sewing machines—527—W. Winter.
Sewing machines—535—J. Starley.
Sewing machines—551—R. Barclay.
Spinning mules and throstles—323—E. Williams and T. Williams.
Spirituous liquors, apparatus for distilling, &c.—574—C. J. Falkman.
Spring knives, bolsters for—560—A. Davy.
Stamping machine—2769—L. C. Meaulle.
Steam generating, &c.—2811—W. C. Thurgar and R. A. Ward.
Twist lace machines, manufacturing lace in—566—J. Hartshorn and W. Redgate.
Vapours and fluids, condensation and refrigeration of—572—G. H. Barth.
Weaving, looms for—503—A. Barker.
Weights, apparatus fot raising—526—J. Hundy.
Wood, machinery far sawing—523—S. W. Worssam.
Woven fabrics, apparatus for shearing and burling—517—W. D. Gedge.
Woven fabrics, apparatus for blocking—536—T. Dronsfield, T. E. Jones, and John Ashton.

Invention with Complete Specification Filed.

Marine steam engine—643—J. Dean.

Patents Sealed.

2062. F. Kreuz.	2329. T. Walker & T. F. Walker.
2297. C. F. M. Jessen.	2336. M. Henry.
2302. S. Bates.	2385. N. Thompson.
2307. C. W. Howell.	2461. W. Anderson.
2310. E. Smith.	2485. W. Gardner.
2315. E. T. Hughes.	2539. J. H. Dallmeyer.
2316. G. Scott, jun., and J. Tudor.	2612. G. E. Donisthorpe.
2524. F. L. M. Dorvault.	2615. R. Hornsby.
2325. G. G. Bussey.	2642. G. E. Donisthorpe.
2328. J. Clark.	19. E. Keirby.

From Commissioners of Patents Journal, March 21st.

Patents Sealed.

2345. W. Carter.	2467. J. P. Turner.
2349. W. Greener.	2473. C. Chapman.
2352. J. T. Stroud.	2484. J. G. Beckton.
2353. R. Hattersley.	2497. J. I. Vaughan.
2354. G. P. Wheeler and J. F. Gloyn.	2540. O. L. Hopson and H. P. Brooks.
2357. W. Scott.	2559. A. Hill.
2366. H. C. Symons.	3228. R. H. Leese.
2369. G. B. Cornish.	45. J. Craw and J. Macaulay.
2378. G. Davies.	155. W. R. Foster.
2380. W. Whitehead.	203. A. C. F. Derocquigny and D. Gance.
2384. J. and W. Weems.	
2417. J. S. Grimshaw.	

Patents on which the Stamp Duty of £50 has been Paid.

703. G. H. Birkbeck.	736. W. Barford.
707. G. T. Bousfield.	752. W. Tongue.
708. A. J. Paterson.	785. J. Newall.
709. M. A. Muir and J. McIlwham.	841. W. L. Winans.
727. W. Clark.	1078. G. Fell and W. Haynes.
751. T. Dunn.	730. W. B. Lord and F. H. Gilbart.
836. R. Boby.	744. T. Myers.
903. H. Pooley, jun.	778. E. Field.
739. J. M. Courtauld.	801. J. H. Tuck.
765. R. Wilson.	767. R. A. Brooman.
732. W. Bowser.	768. R. A. Brooman.
734. J. and W. Weems.	

Patents on which the Stamp Duty of £100 has been Paid.

597. I. Holden and E. Hubner.	587. W. E. Newton.
560. A. V. Newton.	813. A. V. Newton.

Registered Designs.

Field's Lighting Wick—March 11—4701—John, Charles, and John Field, Upper Lambeth Marsh, Surrey.
Arm of Mantelpiece Fire Screen—March 15—4702—W. Tonks and Son, Birmingham.
Self-regulating Rack Bracket—March 21—4703—R. Evered and Son, Surrey Works, Bartholomew-street, Birmingham.

THE
Journal of the Society of Arts,
AND OF
THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, MARCH 31, 1865. [No. 645. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

April 5.—"On food for Cattle." By Professor John Coleman.

April 12.—Passion Week. No Meeting.

Cantor Lectures.

The Third Course for the present Session will consist of six Lectures "On Some of the Most Important Chemical Discoveries made within the last Two Years," to be delivered by Dr. F. F. Crace Calvert, F.R.S, F.C.S. (Corresponding Member of the Royal Academy of Turin ; of the Société Industrielle de Mulhouse ; of the Société Imperiale de Pharmacie de Paris, &c.), on Tuesday evenings, at Eight o'clock, as follows :—

April 4th.—Lecture 1.—On the discoveries in Chemistry applied to Arts and Manufactures.

April 18th.—Lecture 2.—On the Discoveries in Chemistry applied to Arts and Manufactures (*continued*).

April 25th.—Lecture 3.—On the Discoveries in Agricultural Chemistry.

May 2nd.—Lecture 4.—On the Discoveries in Physiological Chemistry.

May 9th.—Lecture 5.—On the Discoveries in the Chemistry of Rocks and Minerals.

May 16th.—Lecture 6.—On the Discoveries in the Chemistry of Metals and Alloys.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture.

Proceedings of the Society.

Seventeenth Ordinary Meeting.

Wednesday, March 29th, 1865 ; Sir Thomas Phillips, Q.C., Vice-President of the Society, in the chair.

The following candidates were proposed for election as members of the Society :—

Austin, Charles E., 7, Broad-sanctuary, S.W.
Bradley, E. B., 1, Church-meadows, Sydenham, S.E.
Brown, George, Bruckwood-house, Croydon, S.
Buckney, Thomas, 12, Brunswick-square, Camberwell, S.
Canning, L., Abbey-wood, S.E.
Chambers, W. Oldham, Lowestoft.
Cook, Rev. John, Elm-grove, Southsea.
Costeker, John, St. John's-hill, Wandsworth, S.W.
Da Silva, Johnson, Beach-house, Bognor.
Laslett, Thomas, Devon-house, Maryon-road, Charlton, S.E.
Lewin, William Henry, 135, Southampton-street, Camberwell, S.
Lloyd, Percy, Ash-villa, Burnt-ash-lane, Lee, S.E.
Lucas, Charles, Royal Academy of Music, Tenterden-street, W.
Massey, Hugh H., 33, Camberwell-green, S.
McArthur, Alexander, Raleigh-hall, Brixton-rise, S.
McEwan, James, 38, Cannon-street, E.C.
Nagle, Rev. W., 1, Blackheath-villas, Blackheath, S.E.
Parker, Thomas, 10, Brunswick-square, Camberwell, S.

The following candidates were balloted for and duly elected members of the Society :—

Brandt, F. C. W., 3, Abchurch Chambers, Abchurch-lane, E.C.
Drake, Francis, Friar-lane, Leicester.
Jacobs, Lewis, 146, Strand, W.C.
Kiel, George Middleton, 16, Stanley-gardens, W.
Oakes, William Smith, Addison-road, Kensington, W.
Simes, N. Phillips, 58, Coleman-street, E.C.
Strachan, Mrs., Norfolk-house, Arundel-square, N.
Wilkin, Frederick, 10, Spring-gardens, S.W.

The Paper read was—

ON WINDOW HORTICULTURE, AND THE CULTIVATION OF PLANTS AND FLOWERS IN CITIES AND CROWDED LOCALITIES.

By John Bell, Esq.

The insufficient dwellings of the poor, and the best mode of ameliorating them, have always formed one of the subjects to which this Society has been desirous to give its aid ; and, as you are aware, within these last two years a greater amount of action has been taken thereon. In harmony with this, the subject which I introduce to

you this evening may claim your indulgence, as, at any rate, in part directed to the same end. Flowers and plants at windows, and floriculture and horticulture in cities, may be equally pleasing to the rich as to the poor; but while to the former it is easy, by change of place and scene, to be, in brief space of time, amid the luxuriance of flowers in the country, the poor mechanic, resident in London, detained by his daily work, has not time, money, or opportunity for a similar change, and to him, in consequence, the few flowers and plants he can raise and see bloom under his own eye, if indeed only at his window, are proportionately dear, and indeed a treasure.

Amongst the revelations of the railways are those by which we look down upon the tops of houses in some of the poorer parts of London, and those inhabited much by the artizan and workman. As the train moves slowly in starting from or coming into this great town we have many of these glimpses into modes of life differing from those of the residents of other localities, and perhaps larger houses. Among the tastes that we see pre-eminently displayed here, are the love of birds and the love of flowers; and various are the expedients improvised, and of home manufacture, for the indulgence of these tastes and the accommodation of either class of natural history. With the pigeons and canaries, on the present occasion, we have nothing to do, but as regards the accommodation of flowers and plants, we may well remark the variety of expedients to which the love of Nature, and at the same time the narrowness of space and means, drive the enthusiast. Tubs, pails, baskets, crockery of many kinds, troughs, glasses, bottles, and almost every kind of receptacle are enlisted in the service of his taste and the worship of Flora; and in more than one ambitious instance I have seen the top of some small outbuilding covered with a layer of earth, for the accommodation of flowers and shrubs, and fenced round with boards and slates on end, to keep them in their place within their narrow bounds.

This last-mentioned arrangement, indeed, seems, on a very small scale, to be similar to that which the celebrated hanging gardens of the city of Nineveh exhibited on a very large one so many hundred years ago. Of those famous gardens the old historian Diodorus Siculus gives us an account, not very much to the purpose, inasmuch as he left all the world much in doubt what they were. But of late years, since the discoveries which have taken place in and about ancient Nineveh, more light seems thrown on the subject, illustrating the mode in which they were really constructed. Earth was laid on in a stratum of not less than six feet in thickness, with no doubt good arrangements for drainage beneath; this mass and extent of elevated earth was apparently treated in all other respects just as a garden on the level of the ground, having been planted with trees and laid out into parterres with walks intervening, where the monarch and his court, or the priests and their devotees could promenade in shade and elevated seclusion, and enjoy the prospect over the wide valley of the Tigris. It may be remarked, *en passant*, that the depth of the soil of these gardens is further and happily illustrated by the service they have rendered to history and art; for when the great fire took place on the capture of the city, 600 years B.C., the upper stories of the architecture being of wood, were easily burnt, and the superincumbent gardens fell in a mass, covering up at once the elaborately sculptured walls of the basement, thereby not only at the time protecting them from the hand of the invading armies, but in great measure for centuries to come, from the still more destructive hand of Time, as is visible in the remarkable freshness of many of these most valuable historic works of art, as now seen in the British Museum after a lapse of more than 2,400 years.

Far removed as these incidents are from us in time and place, they are not without their immediate familiar interest with us as regards the present subject, as they afford the earliest example on record of town gardening in connection with architecture, and that in relation with one of the most celebrated and populous cities of ancient time. In considering this, it is evident that in that warm climate these gardens answered two purposes, not only that of a charming and most private resort, not overlooked from any adjacent spot, and at the same time enjoying whatever breeze there might be stirring, as well as an extended prospect; but also, at the same time, they provided for the coolness of the apartments beneath in the same manner as the inhabitant of the same region now shields his head from the rays of the sun by the multiplied folds of his turban. In this climate we have certainly not all the same reasons for masses of earth on the tops of our houses; but I confess I cannot see why something of the same sort might not, as regards growth of plants, be adopted occasionally in our cities, by making the top story with a glass roof instead of a slate one, by which means we might obtain above our attics an additional apartment or apartments of a greenhouse character, where plants might be grown in much perfection, and which at the same time would be available for workrooms of various kinds, for artists' studios, and for many of the purposes requiring light in this great busy city; for it may be remarked that that compound nebula, a London fog, though deep in colour is not so as a stratum; it lessens rapidly in density as you ascend, although it has occasionally almost a definite top-surface to it, above which all is bright. For instance, I have had an acquaintance of some years standing with a thrush in Kensington-gardens, who has a fine flow of spirits, for he sings nearly all the year round. He affects one particular tree, on the top of which, when I have been walking below in the dense fog of November, I have heard him up above on his branch, in the clear sunshine, warbling away in the fulness of his fruity notes. Individually, I may say, that if I had to build my own house over again, I would adopt this arrangement of a greenhouse upper story. I can hardly think but that in this great town, where so many ideas are realized, this has not been one of them, although I have never heard of it as a system, which I now submit to the indulgence of the architects of the time.

Following the ancient period above mentioned—for these gardens of Nineveh were destroyed 150 years before the Parthenon was begun—the Greek exercised his native taste in the association of gardens with architecture. I have not space to detail what is known of these, and will only quote one passage from an interesting paper on the "gardens of the Greeks," in *Chambers' Journal*, for August 31st, of last year. The author there says as follows:—"When the Greek was shut up hopelessly in a city, he created on his window ledge a garden for himself, either, if rich, in a silver basket, sculptured all over with rustic imagery, or, if poor, in one of wood or osier, where he fostered and allured into bloom the denizens of distant mountains and valleys." He adds, *en passant*, "At any rate, no people but the English have ever been fonder than the Athenians of rural architecture."

From the Greeks we naturally come down later to the Romans, who had a special phrase for this introduction of Nature into towns (now somewhat hacknied by much use) of "Rus in urbe;" and this was much realised in Rome, where the advantage of "Open spaces" was as highly appreciated as with us, and where the great did service to the people by the appropriation of large gardens for their recreation. As far as we learn, however, from the domestic records of Rome, this "Rus in urbe" was not confined to public places in that city, nor an empty phrase even as applied to domestic residences, but the divinities of gardens were among the Roman's most cherished household gods, no home being complete without a garden, though it might be a small one, the kind of pretty little household garden which was considered a requisite adjunct to a residence of taste being very well illustrated in the Pompeian house in the Crystal Palace.

Household gardening also is illustrated in the arrangements of the Alhambra; and the Turks, Persians, and Chinese all favour gardens in connection with their city

dwellings. Indeed, it may be said that this taste, to a greater or less degree, accompanies civilization and refinement among all nations. I daresay, however, that all will agree with the remark in *Chambers*, that, at any rate, no people are greater lovers of Nature than the English at the present time, and that although, in the scientific treatment of subjects of natural history, other nations may be, in some points at least, our equals, yet, in the general popular love of natural history in its varied forms as existing in the heart of the people, it is not too much to say that the inhabitants of no country are so thoroughly imbued with it as the English man, boy, woman, girl, and child. In illustration of this, the popular books on these subjects for all ages, published annually in London, outnumber, I hear, those published in all the rest of the world together; the bearing of which being that, in affording facilities for the cultivation of a taste for Nature in one of its most elegant departments, that of the growth of flowers, they are not likely in this town to fall on barren ground. It must, indeed, be acknowledged that the quiet excitement of tending plants and seeing them grow, is all good—it has no bad side. It is an excitement without reaction, and so a healthy one. It is a phrase that "cleanliness is next to godliness," and it may be added that the love of flowers is akin to cleanliness, and so but one remove, at least, from godliness. In a charming little book by the Rev. Haddon Parkes, formerly of Bloomsbury, now of Putney, they are associated together. The title is "Window-gardens for the people, and clean and tidy rooms;" and various of the facts contained in it illustrate the relation of the three qualities.

Thus helping the sentiment for the cultivation of flowers, seems helping the good side of human nature. I met with a pleasing remark some time ago, in a book of travels in the North, entitled "Through Norway with a Knapsack," in which, as a pedestrian wayfarer, on the humble footing, to which he had restricted himself in his tour, the author, Mr. Williams, had to find lodgings in strange cities and out-of-the-way places, and his remark is to the effect that he found no surer guide to the houses of good, kindly, cleanly, and honest people, than the presence of flowers at their windows, insomuch that at last he took these simple signs of Nature as his clue to a friendly welcome, a clean bed, and an honest bill in the morning. I find that Mr. Parkes quotes an observation to a similar purport by Erskine Clarke, that "flowers growing in the window sills of the poor are one of the safest indications of a well-ordered and cheerful interior, and that they are among the most reliable of advertisements;" and Mr. Parkes adds, "it is well known that in large towns, such as Sheffield, Birmingham, Manchester, and Coventry, those who cultivated flowers partly from the love of them and partly because a knowledge of them is necessary to their calling in life, are amongst the most skilful, industrious, and exemplary of workmen."

I do not enter upon the chemical question, as to the effect of plants upon the sanitary condition of rooms. I leave this question to those who have studied it; I have not. I hope there may be some one in this room who can treat this point, and will favour us with his remarks. I know it used to be said that flowers and plants were injurious in sleeping-rooms, which the workman's living-rooms frequently are. Of late, I understand, a different opinion has arisen, that the presence of flowers is advantageous. I hope it is so, for I am glad of everything that can be said for flowers. At any rate, however, nothing can be said against flowers outside of the window. Flowers at an open window, either for sight or fragrance, cannot but be healthy, and this I conceive to be in general the best place for them.

It must not be supposed, however, that I fancy myself a pioneer on this subject. Others have been before me whom I am only happy to follow so as to contribute my mite of experience. But having been a window gardener for some years in a suburb of London, my success leads me to think that domestic gardening of that kind is only in its infancy; an art which derives its great interest from its being available where no other gardening is—to the artizan of the metropolis, in the most crowded parts of which ground is let, as it were, by the square inch, and is too valuable to be expended in space for gardens. Besides, in places where the houses are close and high, plants will scarcely grow better at the level of the ground than at the bottom of a mine. To this point, in the *Gardener's Chronicle* of May 14th of last year, Miss Maling draws attention. "First, then," says this authoress, "we must remember the incalculable advantage to all town and London-grown plants of being lifted up from the ground. The first time I tried the plan myself it was that there was a back garden, deep down and well-like, in which not a thing would grow. A little breakfast-room looked out upon this 'dampery,' and there I got my boxes fixed, raised above the level of the surrounding walls, the plants enjoying the free current of air that now passed around them. The way in which that garden throve attached me for life to this plan. The soot and smoke may be bad in towns, but that I do not think is the real grievance. They can, after all, be washed off. It is the stagnant air, or the no light in some cases, the scorching sun in others, that stunts and kills town plants."

Now as the artizan in London seldom occupies a whole house, it is rarely but of a window or two that he is lord and master, and thus his gardening in town must be more or less in such situations; thus the prizes which have been offered for the growth of flowers in London have been chiefly responded to from windows. In more than one parish has this been the case, that which rejoices in the happy name of Bloomsbury being, I believe, the foremost. Here the subject has met with sundry supporters, and under the auspices of the incumbent, the Rev. Emilius Bayley, and the Rev. Haddon Parkes, many rewards have been distributed among the poorer classes for the growth of plants, chiefly as above mentioned, in that and adjoining parishes.

From the little work published last year on this subject by the latter gentleman, I shall venture to quote largely, in proportion to my own remarks; my own especial practical mission, I may as well say, having been rather the suggestion of mechanical means for facilitating such open-air town gardening and the testing them myself by the growth of seeds and flowers in them for the last three years, than any higher or more philanthropic fostering of this most civilizing and cheering taste.

With this parenthesis, and turning to the directions of Mr. Parkes upon this branch of horticulture in cities, I would express my own belief with his, that in the upper stratum of air at windows even in the midst of London, at the present time, many flowers will grow well with care and proper appliances. The prizes given at the Bloomsbury Shows, for flowers grown within the parish, were chiefly for fuchsias, geraniums, and annuals. Mr. Parkes, in his account of them, says that competition was confined to these because they are inexpensive and easy to procure, but adds that experience has shown that many others than those named can be successfully cultivated in London by the poor; he mentions occasional syringing or careful washing of the leaves of the plants, which are their lungs, from the smoke or dust, as of much benefit to them.

With a view to give a sketch list of such plants as may give response to the care bestowed on them, I have put together such from various sources, from the suggestions of Miss Maling and Mr. Eyles, the superintendent of the Royal Horticultural Gardens, in Kensington, as well as from those of the Rev. Haddon Parkes and from my own trials—any shortcomings in the list are, doubtless, my own:—Fuchsias and pelargoniums of most kinds, window balm (which bears small lilac flowers in August), lavender, thyme, bergamot, sothernwood — that is "old man," as it is often called, which does pretty well everywhere, and is very pleasantly aromatic. The yellow and white stone crop also grow well, but

the pink requires a free mountain air. Creeping Jenny is a kindly flower, with its little yellow blossoms at every joint, and does well almost everywhere. Candy tuft also is easy of growth; also the common British aloe (or house-leek). This has the same habit of flowering as the other aloes—that is, only occasionally—so that, out of a large family group of star-like plants, only one or two, perhaps, will shoot forth their tall flowers in a season. Of this household plant, Gerard, in his "Herbal," speaks very highly for the cooling virtues in medicine, as in healing green wounds, &c., and it is even now thus used in some parts of the country. Apropos of this, we may call to mind that this same old John Gerard, who was so much respected for his botanical lore in his own time, and so deservedly even now, lived in Holborn, and in his large "Herbal," or book of plants, he dates his address to his readers—"From my house in Holborne, this first of December, 1597;" where, also, he had his garden.

The golden Marys, or marigolds, as they are commonly called, do well, but are rather pale if they have not plenty of sunshine. The daisy, or day's eye, from whence its name so familiar to us, does well for one season. As a passing observation, we may see how peculiarly happy is this name, for even when the flower is closed, its delicate petals lap over, like eyelashes. Also the pansies, so called from the French "pensées," or thoughts. Also mignonette, which, although we call it thus in French, mignonette, or "little dear," in France is called "reseda." Wallflowers do well; also Virginia stock; and the gazania; also sweet William pretty well; also, for a season, primroses of the various kinds, and most hardy annuals will come up from seed and bloom where the air is pretty free and there is sunshine.

As regards shrubs, the original old English evergreen of our forefathers, now of late years again come into fashion, the phyllarea, or British olive, does well; also the aucuba japonica, pyrus japonica, and genista, and even the golden furze or whins of the wild heath will bloom sometimes surprisingly well in our metropolitan atmosphere. Also may be added to this flower list—chrysanthemums, lobelias and verbenas of most kinds, including the lemon-plant, the anemone, canariensis, ipomea, tropœoleum, clematis, sweet pea, also the bindweeds or convolvuli, larger and less; also nasturtiums exceedingly well, both the dwarf and other kinds. These may be raised from seeds in the spring or by cuttings later in the year. The flowers of this plant are very pleasant as to both eye and taste, introduced in salads, as well as the seeds for pickle. If sown it should be in April.

Mustard and cress, as well as musk, of course do well; also calceolarias—the common kinds, and heliotropes pretty well; also cinerarias; also ivy, of course, and Virginian creeper; also ferns of most common kinds, if carefully syringed and washed. Crocuses and snowdrops, and all the early bulbs, do well, but are late in exposed situations; perhaps of all these none are more likely to answer than the early tulip. I have also found the scarlet-runner do well in this situation. These plants are grown in some places only for their beautiful flowers, as in parts of America and Scotland, but here they are chiefly used for the table. Thus they have a double claim to our esteem.

The above list I have ventured to give only for revision, and I would add that it is only experience that teaches us the most available plants for city household horticulture and the best means of managing them. I would add that of all the geranium kind the common horseshoe-leaved variety is that which Mr. Parkes speaks of as having flourished best in Bloomsbury and St. Giles's. I cannot leave what this gentleman says without further quoting him in respect to the benefit which he speaks of as having accrued to the poor of these localities by the fostering of their natural love for flowers. "Many instances," he says, "of the way in which this love for flowers evinced itself came under my notice, and I will mention two or three as illustrations of the strength of this love as proved by the efforts made by individuals. A poor man, living in a close little back room on the third floor, and eking out a wretched existence by ill-paid army work, transformed an old fish-basket into a small garden. In this he had sown a few simple annuals, but they were all so well grown and so tastefully arranged, that Mr. Sowerby, the judge at the Russell-square Flower Show, specially recommended them for an extra prize. A poor widow, living in a back cellar, into which the sunshine came only for one hour in the day, anxiously watched for that hour to come round, in the hope that her geranium might have every chance. The result of all this care was not very encouraging, for the plant only just lived and never attempted to flower. But yet it was a great comfort, notwithstanding, to this poor woman. She said to Mr. Parkes, 'I never thought before that a flower would live in my room. I did not believe before that I should ever care for anything again in this world like as I have cared for that geranium. Indeed, sir, I've got almost to love it as if it could speak.'

"A poor man, into whose room sunshine never came, with a zeal and energy worthy of praise, made an ambitious attempt at a conservatory by means of an old orange box, and a second-hand window sash, which he nailed against the wall of the back-yard of the premises in which he lived, and exhibited some very creditable specimens of plants grown under difficulties.

"There was living, at the time of the first flower show, an old man, whom no one could induce to leave his room. The clergyman, the Scripture-reader, and the City missionary had all failed to move him, and their arguments were as nothing to him. He had lived so long in seclusion, that, as he said, 'he was ashamed to be seen in the street, the people would all stare at him so;' and so strong a hold had this strange feeling on him, that for years he had not crossed the threshold. A plant was given him, in the faint hope that it might supply him with a fresh interest in life. He was greatly pleased, and bestowed much care and attention upon it, and at the time of the show brought it in his own hands to the room, saying that he would not trust it to the care of any one else. He had a prize, and, to the surprise of us all, without any personal solicitation, he afterwards presented himself at the Sunday evening service, and became a regular attendant there.

"Other instances might easily be produced to show the individual interest which was taken, but enough has been said to prove this. At the workmen's club it was an absorbing topic; a rivalry was established between certain members of the club. Geraniums were matched against geraniums for the prize, and annuals against annuals; and the best mode to water the soil and wash the leaves of the plants was a frequent subject of discussion. One man had the temerity to say that he could grow a cauliflower, and that before another show he would make the attempt. After the last exhibition the members of the workmen's club were so satisfied with their powers as flower-growers, that they said they were willing to grow flowers against any other club of working men in London. No one, I think," adds the author, "with these facts before him, can doubt that, whether we look at the general results of the flower shows or the individual interest as proved by these examples, there is a real love of flowers among the working classes of London." No doubt, indeed, this taste may be said to be innate in nearly all. Bacon, Lord Verulam, who is so good an exponent in few words of large facts, says that the "Almighty first planted a garden," and "that it is the purest of human pleasures," adding, "that it is the greatest refreshment to the spirit of man, without which buildings and palaces are but gross handiworks." Thus does the philosopher express not only the universality and propriety of the taste for horticulture, but also suggests indirectly its familiar association with architecture.

The love of flowers among the richer classes in London

is evident enough. Rarely do you enter a large house without seeing proof of it. And we may be certain also that it would be more frequent than it is in the dwellings of the poorer and working classes had they improved facilities for it. Moreover, there are the Soldiers and Sailors. I have heard that the first fuchsia seen in this country was discovered in a pot at the window of a sailor's wife in one of the semi-marine regions of Wapping or Rotherhithe, by some wandering and wondering botanist, whose steps chance had led that way. Even if in the particular instance of this beautiful plant this be a myth, yet I believe I am not in error in saying that for many valuable early introductions into this country from foreign parts of beautiful and useful plants, we have been indebted to our sailors. Might it not be then but fair for us to see if, wherever there are poor sailors' homes, either on water or on land, we might not offer them facilities for flower growth, and perhaps encourage them by prizes?

Also in respect to the sister service, the army, I do not know any class to whom facilities for the gratification of this taste would be more welcome. It has been suggested to me by a good military authority that many of the soldiers might like to grow mustard and cress at their barrack windows in preference to flowers. I am not so sure of this. But if it were so, no matter. There is a charm even in watching so simple an operation of nature as the development of a cress-seed into a plant, and none the less so because the plant responds in food as amusement. And this amusement is of a home-like character, and might well lend a relief to the monotony of a barrack life. At the windows of some of the barracks in London are accordingly to be noticed expedients for the growth of flowers. It has been suggested to me again that these perhaps are the windows of non-commissioned officers. They possibly have the most leisure, but window gardening is just one of those things that take no appreciable time, and I believe in the almost universality of the taste without reference to station. The existence of this taste among those of whom by far the largest part have formerly been private soldiers (I mean the Chelsea pensioners), is to be seen in the garden plots they occupy in the grounds of Chelsea Hospital.

The part of London around that institution has been much improved of late, and no pleasanter Sunday afternoon may be spent than by going first to the chapel service at three o'clock, where the old pensioners form the larger portion of the congregation, over whose heads hang the banners battered in many a conflict, and after service strolling in the large and varied grounds belonging to the Hospital, which have been laid out with much taste. One thing I am sorry for, viz., that the plots allotted to the old pensioners have been removed from their original situation to a part less favourable to them; but still they form to me the most interesting part of the whole grounds. These little allotments of garden ground are between five and six yards square each of them, and it is entertaining to see the variety of treatment they display. In some you see a little hut built as a garden seat; in others, an improvised greenhouse; in others, monumental trophies, grotesque heads, and plaster casts, are interspersed in the borders. Some are utilitarian, and grow vegetables; others ornamental, and devoted to flowers, and most combine both. Among them were several plots for the raising of musk plants, and, as as respects one plot, I was informed that the season before, by the careful management of the occupant, he had realised £6. The embryo or young musk requires much care during the winter to ensure its early growth. This plot was so arranged that in the spring, when the street hawkers of musk came to buy it, it could be easily removed with the layer of earth in which it grew without disturbance to the roots, which is a great point, as I was told by a cheerful old pensioner I met there, who was my ready informant, but not the tenant of the plot in question. And I have been further informed that at one time the chief supply to London of musk plants was from the little plots of these old soldiers; and even now that musk has become a much commoner plant, and there many other sources of supply, their occupation in this way is not quite gone. These evidences, however, are enough to show that the love of flowers and gardening is anything but dead in the soldier's heart, and some encouragement would doubtless give it fresh vitality.

I also met lately in a report of the gardening of some of our regiments in India, that the men were very readily pleased with that occupation when the gardens were near, but that they did not like to go far to them. But here they might have them in miniature at their barrack windows, where, as in cities, no other space could be afforded them. I am glad thus to see in the almanack sheet and programme of proceedings for this year of the Royal Horticultural Society in Kensington, of which I have the pleasure and amusement to be a member and neighbour, that prizes are offered to both sailors and soldiers for the growth of flowers. The area of such encouragement might be further extended, as to almshouses, model lodging-houses, and the convalescent wards of hospitals; and if, in the first instance, in the construction of these and of barracks, it were to enter into the plan to provide facilities for such domestic growth of plants at elevations, especially at windows, accommodation might be easily ensured for much larger masses of earth than have hitherto been attainable, and with excellent architectural effect, in which the string courses, for instance, might take up and continue the line of structural fixtures necessary for the receptacles in question. I think, also, that if we look back for a few years, we may perceive that the public taste has been going in the direction of freer and larger accommodation for flowers in connection with dwellings. Formerly a few separate pots of flowers were all we saw at windows, confined by perhaps a bar of iron for safety. Then came the wooden mignonette and flower boxes, which now for some years we have seen in terra-cotta also, prettily wrought. And now we find commonly about in the best parts of London receptacles of a larger size and more elaborate decoration on the window sills of our largest houses, and faced with the beautiful tiles of Messrs. Minton and others of our best manufacturers. Having myself been for some years a window gardener, and my plants thriving better at my windows than in my garden below, it naturally suggested itself to me to provide receptacles of a still larger size, and my windows being French casements, opening outwards, I could not have them on the sills. I therefore projected these receptacles further out, and so that the top of the earth contained in them should be level with and not above the sills. I had these made in iron by the Coalbrookdale Iron Company, so as to contain as much as two barrowfuls of garden mould, besides two inches in depth of fragments of flowerpots broken small for drainage. These are capable of perfect support by various means, as I have tested; but I think the best and completest is where the receptacle or "window garden" is made in one casting with the window-sill, which, being let or fixed into the brickwork at the base of the window, like other window-sills, only a little further in, the whole affair becomes perfectly self-supporting to the extent of five times the weight of earth that can be put in it. By this means, also, no damp can enter the wall, and the drainage is provided for. Practically there is no appreciable drip, the mass of earth, in common cases, absorbing and evaporating the moisture. But in the case of ferns, and any plants requiring a superabundance of moisture, two little sixpenny tins, of appropriate shape, hung over the sides, catch the drip from the two drainage holes, which are amply sufficient, inasmuch as there are two inches of drainage all over the bottom of the window-garden, as mentioned above, which runs off the superabundance into the drainage tins, which may thus, from time to time, be again emptied into the window-garden. These also evidently afford safety at nursery windows; they are capable of being glazed wholly up the window, or partly up, as may be

seen in front of a house in Piccadilly, and they might be even heated by pipes, &c., &c., but in all cases evidently the first point is to obtain a firm substructure and support.

In this kind of iron window-garden I have had much success in raising plants and flowers from seed in the usual way, and also when bedded out, when they have thriven with marked luxuriance; and this not only at my own house, but in some experimental receptacles in the Royal Horticultural Gardens last year, during which the same flowers flourished, without renewal, throughout the season, until late in the autumn, and although they were raised but a few feet from the ground, yet, from some unexplained cause, the growth and bloom of the plants and flowers in them was much superior to that of similar kinds near them, growing in the usual way in the earth. Whether this was owing to a greater amount of air getting to the roots of the plants in the window-gardens, and so stimulating them, I know not, but this difference of luxuriance, and continuance of bloom, was remarked by many. The plants in question were chiefly deutzia gracilis, heliotrope, pelargoniums, scarlet geraniums, fuschias, genista, calceolarias and scented petunias, and gazania splendens.

With early bulbs, in these window gardens, I have not had such marked success. Although they are in fair bloom now, they are little better or earlier than those in my garden below, and by no means show the same superiority as the geraniums and summer plants. This I attribute to their exposed and unprotected position during the winter, high in the air, and thus perhaps the same quality and airy situation which favours the later plants, acts adversely to the early ones. The window-garden, indeed, is attacked directly by frost below, in front, and at the sides, as well as at the surface of the contained earth; and this year, with its alternations, has been a trying one. Next year, however, I mean to try matting closely these window-gardens below, and round the sides, the matting lapping over the top, so that on fine days it may be easily opened from the windows, to let in the air and sun to the plants, and I hope by this means that while I retain the advantage of their high and airy position for the bulbs, on the other hand I may shield them from the alternations of frost.

It were easy, of course, to have the bulbs forwarded in a conservatory in pots, and then that they should be plunged in the earth of the window garden when the winter is over, but my aim has been to treat these receptacles legitimately as affording miniature gardens in all respects, without, however, of course, any prejudice to their being used in other ways as merely the receptacles of pots, as might be preferred by others.

There would be no excuse for my attempting to enter in detail on other branches of raising plants and flowers beside those of which I have had individual, and perhaps novel experience. As regards, however, other facilities for city gardening for indoors as well as out, I cannot well treat the subject without allusion to them. Excellent information on these matters is to be found in two little books by Miss Maling, entitled "Indoor plants, and how to grow them," and "Flowers and foliage for indoor plant cases;" also in a manual on window-gardening by Mr. Robert Fish; and on the table you will see these illustrated by the various appliances arranged there.

All the devices and graceful arrangements, of which these are samples, are evidences of the increase of the love of flowers in the population generally, and the desire of improvements in accommodating them, and fostering their growth either within or directly attached to houses; and when in London we walk abroad, we see proofs as marked in the great improvements of our public parks in this respect, not only in the more courtly quarters of St. James's, Regent's-park, Hyde-park, and Kensington-gardens, where we are so much indebted to Lord Llanover, Lord John Manners, the late Mr. Fitzroy, and Mr. Cowper, the present first commissioner, but they are equally visible in Battersea, and also in Victoria Park, where Mr. Preston, aided by various gentlemen, is forward in the development of the same taste. Nowhere, however, can a better display be seen than at the Crystal Palace, where the genius of Sir Joseph Paxton has so well combined art and nature. In another direction from this great city, it is a delight to see its inhabitants enjoying the varied sources of interest and information in the Royal Gardens at Kew, so much improved and improving under the scientific and refined taste of Sir William and Dr. Hooker; and beside these are the Horticultural Gardens at Kensington and Chiswick, and the Royal Botanic Gardens in Regent's-park. But we need not travel so far a-field, at least, for an autumn show of flowers. Nothing can illustrate the prevalence of the love of flowers more than its penetration into the very citadel and temple of law itself. Not far from here, and in the heart of town, as you all know, is to be seen yearly a beautiful show of flowers in the Temple Gardens, chiefly chrysanthemums, under the management of Messrs. Broome and Dale, the Temple gardeners.

Moreover, the smoke of London is lessening. The Thames is to be purified, and we are to have a Thames embankment, vieing, we trust, in beauty and magnificence with any river-side terraces in the world, and here we may well hope that our love for horticulture in connection with architecture, as indicated by Bacon, may find an adequate development, and the more the subject of the growth of flowers and plants in towns is winnowed, the better shall we be prepared to deal with it when it may come to us on this large scale. It has been suggested several times of late that this embankment and these terraces should be decorated by art; so be it, but let Nature come in as well to add her decorations, and the study of what plants and what flowers thrive best in cities, and under what treatment and at what elevations, is surely appropriate, when we have in prospect such a scope for the culture of flowers on a large scale, as well as the planting and cultivation of such trees as best thrive in London—as the plane-tree, of which Lord Llanover had so many planted about London—a boon to future generations.

Just now I mentioned elevation as favourable to the growth of flowers and plants in public places in cities, and I will now offer a few concluding remarks as to the same situation in smaller areas as regards domestic gardening. Window gardening is most valuable, evidently, where there is no other space for the purpose, and as affording to almost every one who has a window the opportunity of horticulture on a limited scale. But in many localities, even without going far into the suburbs, there are small garden plots attached to the houses, and in alluding to them as part of my subject I cannot do better than follow Miss Maling's observations quoted above, in which mention is made of the great advantage which arose in her experience from giving elevation to the situation of the plants. I have already mentioned what occurred in the Horticultural Gardens from an elevation of only four feet, and I found the same advantage in my own, which is contracted and hedged round with walls and lime-trees. Here, also, I placed an iron receptacle the same height against the wall on one side, in which I found mignonette grow much more freely than in the borders near, and a genista, especially, increased five-fold in the course of the season, during which it flowered continuously. This led me to the idea of a general raising of all the beds of a small contracted garden, so as to afford them a freer circulation of air and more sun. No doubt this is in some degree expensive, but in a small garden would be no great matter, and, I believe, would ensure the growth of plants and flowers in situations where they would not thrive at the usual level, for every foot of elevation gives an improved stratum of atmosphere. It is evident that something of this treatment is seen in the planting and growth of flowers in large vases, and on trunks of trees sawn into blocks, and on rockwork; but in these cases not at all the same amount of earth or equality of drainage is pro-

vided for. In deep-rooted plants this plan would not be efficacious, probably, as they would hardly change their habits to suit this mode of culture; but for most plants and flowers, such as are usually sown or bedded out in parterres, nine inches, or at most a foot, in depth of earth, with two inches of broken pots below for drainage, would be sufficient. The receptacles for these, whether of iron, terra-cotta, or masonry, would be nearly flat-bottomed and elevated on ornamental standards; and, having made some little sketches of the general effect, although too slight to be used as illustrations, I conceive that the elevation of all the parterres of a small garden in a regular pattern in this manner is capable of much elegance and convenience as well as advantage to the growth of the plants. It would probably be productive of some novel effects in appearance, and would be without precedent, but so much the better for that. I have spoken of its convenience, which would be particularly the case as regards lady visitors and lady gardeners. The crinolines would then find ample space to sweep under the parterres instead of over them, as they often do to the detriment of the flowers, in a small garden, where the walks were not originally laid out in contemplation of that remarkable personal embellishment. As regards stooping also, it does away with the necessity of this either for sowing, planting, tending, or examining the flowers, and evidently their bloom and fragrance are more directly available. Mignonette, for instance, when placed in the ground, you would hardly perceive the scent of in walking by, but raise it some three or four feet, and let it grow there, and it will welcome you with its fragrance whenever you go near. Thus will you be better repaid for your care, and the plant will be much obliged to you.

As it appears to me, this is a plan which might be well adopted in the suburbs, which the closer and loftier march of bricks and mortar is now invading in all directions, and the thus raising the parterres in this artificial manner a yard or so in elevation would be tantamount in effect upon the plants to removing them a mile or so into the country. I acknowledge that the building activity in my own neighbourhood gave rise to this idea in my mind, and although my little garden is by no means yet in the condition to require this general hoisting, yet I confess I hold it in reserve with some satisfaction for the possible time when I may think it expedient, for as far as I have tested the plan, I have found it to be attended with success.

This whole subject of the treatment of flowers and plants in and about great cities is one fertile of ideas, and it does not appear of small interest even in respect to London itself, when we ask ourselves the question, "Of its three millions of inhabitants how large or how small a proportion love flowers, more or less?" I believe the proportion is very large that delight in flowers, ranging from infancy to age. I conceive, indeed, that we may be as yet but on the threshold of the treatment of facilities for domestic household gardening in cities, and I have little doubt that a few years will see us much advanced in this respect. I am rejoiced, therefore, to bring this subject before you in this room, and to be sensible that the few remarks I have offered on it are the furthest possible removed from exhaustive, thus also giving the more room for the observations of others, which may probably be more practical as well as more suggestive than my own. I have indeed confined my remarks chiefly to my own little experiences, which have mostly been in the direction of such kinds of treatment as might be available to the artizan with his two or three windows, or the invalid with his one; in which cases a glimpse might be afforded as it were, of the country amid brick walls, lending a breath and sentiment of poetry to dwellings too apt to be prosaic.

Having thus returned to my starting point, "the growth of flowers and plants in cities," and the cheering adjunct it affords even to the insufficient dwellings of the poor, I cannot, perhaps, conclude my remarks more appropriately than by the quotation of some charming lines by our nature-loving poet Cowper, which, although composed in the last century, are equally applicable in our great town now, and to the present subject. They occur at the end of the "Winter Evening." The poet says:—

"The love of Nature's works
Is an ingredient in the compound man,
Infused at the creation of the kind;
And though the Almighty Maker has throughout
Discriminated each from each, by strokes
And touches of His hand, with so much art
Diversified, that two were never found
Twins at all points—yet this obtains in all
That all discern a beauty in His works,
And all can taste them: minds that have been formed
And tutored with a relish more exact,
But none without some relish, none unmoved.
It is a flame that dies not even there
Where nothing feeds it. Neither business, crowds,
Nor habits of luxurious city life,
Whatever else they smother of true worth
In human bosoms, quench it or abate.
The villas, with which London stands begirt
Like a swarth Indian with his belt of beads,
Prove it. A breath of unadulterate air,
The glimpse of a green pasture, how they cheer
The citizen, and brace his languid frame!
Ev'n in the stifling bosom of the town
A garden in which nothing thrives has charms
That soothe the rich possessor; much consoled
That here and there some sprigs of mournful mint,
Of night-shade or valerian, grace the well
He cultivates. These serve him with a hint
That nature lives; that sight-refreshing green
Is still the livery she delights to wear,
Though sickly samples of the exuberant whole.
What are the casements lined with creeping herbs,
The prouder sashes fronted with a range
Of orange myrtle, or the fragrant weed
The Frenchman's darling? are they not all proofs
That man, immured in cities, still retains
His inborn unextinguishable thirst
For rural scenes, compensating his loss
By supplemental shifts, the best he may?
The most unfurnished with the means of life,
And they that never pass their brickwall bounds
To range the fields and treat their lungs with air,
Yet feel the burning instinct: overhead
Suspend their crazy boxes planted thick
And watered duly. There the pitcher stands,
A fragment, and the spoutless teapot there
Sad witnesses how close-pent man regrets
The country, with what ardour he contrives
A peep at nature when he can no more."

DISCUSSION.

Mr. Varley made some observations upon early methods of domestic floriculture which had come under his notice, and pointed out how the growth of confervæ and other water plants converted hard water from a well into soft water, suitable for watering plants.

Mr. Philip Palmer said the subject which Mr. Bell had introduced was one of great interest and importance to all who, from necessity or inclination, resided in large towns. As one of that class he had for many years attempted to make up for the want of a garden by resorting to the plan recommended in the paper. Living as he did within a few hundred yards from the spot on which they were assembled, he had not even the advantages of Mr. Bell's suburban garden, but, nevertheless, his attempts at floriculture had been attended with very fair success. With regard to growing plants on the top of the house, he found that they were often killed by frost in the winter, and by the sun's heat in the summer. He might mention that,

perhaps, his most successful results had been obtained with currant trees, from which he had gathered crops on a small scale. He had also succeeded in growing some very creditable ferns, of which he had placed some specimens on the table. He stated these facts for the encouragement of others; if they failed in flowers they could fall back upon ferns, which were easily procured. He seldom visited a fresh spot in the country without bringaway some specimens; and his collection (which contained many foreign ferns as well as British) amounted to nearly 700 plants. He also called attention to a plant well suited for window-culture—the *Bryophyllum calycinum*, cultivated by his daughter within his residence. It was propagated from the leaf of the plant itself, and would grow to the height of three or more feet in a pan and glass shade. He should be happy to find that the results he had obtained led others to try the experiment.

Mr. J. Bailey Denton could not allow the observations of the last speaker to pass without saying a word upon the growth of fruit trees under glass. From his own experience he found that these might be successfully cultivated in London and the suburbs. He believed currant bushes would grow very well indeed under glass on the roofs of the London houses, and he was quite sure peaches and nectarines would do so; he knew of no more interesting plant to cultivate under such circumstances than the peach, the bloom of which was very beautiful, and the fruit as it was developed still more interesting and agreeable. He had grown that plant in pots in his own garden, which was not a large one, and they succeeded very well, the trees having, in some instances, yielded as many as two score of peaches each. A more interesting subject than this, he said, could hardly be introduced to urban populations, and he congratulated Mr. Bell on the able and agreeable manner in which he had brought it before them.

Mr. G. F. Wilson, F.R.S., said two or three years ago an article appeared in one of the periodicals, entitled "Orchards in Cheapside," in which the writer recommended growing fruit trees on the roofs of houses in the heart of London. With regard to the growth of plants in rooms, he would mention that he saw a very successful instance of that plan in a monastery at Einsiedeln, in Switzerland, where, in a plain whitewashed apartment, roots of ivy were planted at the four corners, and as they grew were trained up the walls and over the ceiling, the effect of which was very beautiful indeed. With regard to the promotion of this pursuit amongst soldiers, he thought it deserved attention. The Emperor of the French gave the greatest encouragement in this respect to his army in the camp at Chalons; and when a regiment left the camp it was a regulation that the gardens they had cultivated should be broken up, so that the succeeding regiment had to start afresh with the cultivation of the plot allotted to them.

Mr. Sowerby could confirm the statement made by Mr. Bell as to the beneficial effects of encouraging this branch of recreation among the working classes of towns. He had been a good deal concerned in workmen's flower shows, and could state that a marked improvement had taken place in the plants that were exhibited. In the first instance, the shows were very indifferent, but in two or three years a great improvement took place, not only in the variety of the specimens exhibited, but in the cultivation of the flowers. It was stated in the paper that the great drawbacks to the growth of plants in towns were high walls and confined spaces, where it was said the atmosphere was vitiated and was not favourable to the vitality of the plants. To obviate this, Mr. Bell had recommended that the flower-beds should be elevated considerably above the ground. Undoubtedly that was a good plan, and he apprehended it was to be adopted principally for the sake of getting more light and sunshine. He believed the greater luxuriance of plants in the country was not so much owing to the better state of the air as to the large amount of light and sunshine which they obtained there. He would mention that one important element of success in house floriculture consisted in keeping the leaves of the plants free from the deposits of soot and dust to which they were subject in large towns. The leaves being the lungs of the plant, its vitality in a great measure depended upon perfect freedom of respiration, without which vegetable life could not be maintained any more than animal life.

Mr. Slack said after forty years' experience as a "roof gardener" he believed he was approaching to something like success. He began by adding a dormer to the garret in which he slept during the summer months; he then added other dormers, till he had produced what was practically a glass roof. He wished the meeting to understand that he had not adopted that plan entirely with a view to floriculture, but an additional inducement was the opportunity it afforded of enjoying a pure atmosphere. Mr. Slack having described the method by which he had proceeded in converting his roof into a greenhouse, expressed his opinion that flowers and fruits might be grown to a very large extent on roofs throughout London. His own efforts, he said, had been chiefly devoted to the cultivation of the grape vine, in which he had proceeded by different stages and on a gradually increasing scale until he had succeeded in producing grapes which had astonished all who saw them. On one occasion he had gathered as many as fifty bunches of a size and quality that bore favourable comparison with those grown under circumstances commonly thought more congenial, namely, in the hot-houses of the wealthy. His success had been gradual, but by perseverance in his plans he had arrived at results which were highly interesting and satisfactory, proving as they did that the system was capable of being carried out on a large scale throughout the whole of London, very much to the delight of those who had a taste for such matters.

Mr. Wentworth Scott said it was a popular fallacy to imagine that the presence of plants and flowers in a sleeping apartment was unhealthy. It had been asserted that plants at night, when deprived of the influence of the sun's rays, gave out carbonic acid gas, but this was not the case. The fact was that plants, under such circumstances, gave out oxygen, but to a less extent than when exposed to daylight.

Mr. Broome (of the Temple Gardens) expressed the pleasure with which he had listened to the excellent paper of Mr. Bell, who, he said, had shown himself a good gardener, in the various and clever expedients he had adopted for the gratification of his taste in these matters. There was one feature in this subject which he (Mr. Broome) thought specially important, that was encouraging floriculture among the working classes of large towns. He had himself had the satisfaction of assisting in the establishment of no fewer than twenty-four floricultural societies in various parts of London and the neighbourhood, and he had been much gratified by the good results that had ensued from them. These societies numbered from 100 to 120 members each, and exhibitions were held twice a-year. The effects, in a moral and social point of view, were most remarkable; as it was shown that in proportion as a taste for floriculture prevailed among the working classes, their habits and morals became improved. Besides, the love of flowers was imparted to their families, the result of which, he thought, was to be found in the fact that amongst the hundreds of thousands of visitors to the Temple Gardens, including a vast number of children, he very seldom had occasion to complain of any act of spoliation or injury. The societies to which he had alluded gave rise to a friendly and generous rivalry amongst their members in the production of the best flowers, and occasionally some of the members gave short lectures on various matters of natural history to their brethren. Having witnessed the satisfactory results which had obtained among the working classes from the encouragement of a taste for flowers, he had lately gone a step lower in the social scale, and had

turned his attention to ragged schools. He had presented a large quantity of flower roots to one of these schools in Clerkenwell, and had been astonished to find how well they were grown, showing the evidences of careful culture. With respect to shrubs and plants in London he found that what most injuriously affected vegetation was draughts. In parts of the Temple-gardens, where there were keen draughts, the trees and flowers died off. He had experienced more mischief from those draughts than from the smoke of London. In addition to the plants mentioned by Mr. Bell, as suitable for urban cultivation, he might mention the rhododendron. Bulbous plants, too, would grow well if care were taken to plant them sufficiently early. Crocuses, hyacinths, &c., should be planted at the latter end of September, to ensure good blowing in early spring. From not having planted his crocuses sufficiently early last year, he was now almost entirely without those blooms. With regard to that great public favourite, the chrysanthemum, he would remark that there was scarcely a window or house top throughout the whole of London where that really beautiful plant might not, with a moderate amount of attention, be successfully grown.

The CHAIRMAN remarked that undoubtedly Mr. Broome's practice as well as his precepts led them all to feel that there were very few flowers that were more interesting to the denizens of cities and towns than the chrysanthemum. When they observed the wonderful variety in colour, and the extraordinary advance that had been made in the growth of that flower, it was not a matter of surprise that it had become so general a favourite in cities. They must all have felt that a visit to the Temple Gardens during the season of the chrysanthemums was a real gratification, as it was, in fact, almost the only bright spot in London during that gloomy period of the year. That flower was a great favourite with the lawyers; whether it had any peculiar charms for the legal mind he could not say, but it was remarkable that many members of that profession grew that flower in their small gardens in town, and took a special interest in watching its growth. An observation had been made, that very little reference had been made in the paper to fruit-trees. From the title this was hardly to be expected. The paper was intended to be chiefly devoted to floriculture, and he was sure the meeting would feel that this subject had furnished matter, under Mr. Bell's able treatment, for a very interesting paper. Undoubtedly the interest of flowers was equal to that of any branch of natural history. They appealed to the educated mind as well as to the artistic mind; but they appealed also to the humblest mind. The poor man experienced as much pleasure in the floral beauties developed in his small garden, or on his window-sill or house-top, as the rich man experienced in his large gardens and conservatories. Undoubtedly the influence of floriculture upon the human mind was most healthy, whether it was in the humble garden of the cottager, or in the spacious conservatory of the rich, wherever the mind could hold communion with flowers, their influence could not fail to be beneficial and elevating. They must have been struck in the exhibition that took place at the Agricultural Hall last year, by seeing how numerous were the small specimens of natural history exhibited, showing that the working men must have spent many leisure hours in the fields collecting them. But it was not by the healthy alone that the beneficial influence of flowers upon the mind was experienced. It was his lot frequently to visit the wards of an hospital, where he had seen the handful of fresh flowers brought to the bedside of the sick, and how cheering they were to the suffering patient. Again, in those afflictions which resulted in the loss of the mental faculties, they found that there was still a lingering love of the beauties of nature as presented in the form of flowers, even where scarcely any other interest remained. They could not over-estimate the healthy influence of the promotion of this taste, especially among the populations of large towns, for when they looked at the courts and alleys in which a large portion of the working classes were cooped up, they could not but recognise how large a source of enjoyment was open to them in being able to produce at their windows some beautiful, though simple, specimens of country flowers. He had now to ask the meeting to authorise him in their name to thank Mr. Bell for his very interesting paper, on which he had evidently bestowed much labour, evidencing as it did the affectionate interest with which he regarded the subject of floriculture. He trusted none would leave the room without feeling they had spent a couple of very pleasant, and, he hoped, improving hours, in considering this very interesting topic.

The vote of thanks having been passed,

MR. BELL, in acknowledging the kind reception given to his paper, said his own shortcomings had been in great measure supplied, and his incomplete remarks supplemented by what had passed during the discussion. He was very glad the idea he entertained of greenhouses on roofs had been actually carried into effect, and he thought the raising of the parterres would be equally successful when put into practice.

The following articles were exhibited in illustration of Mr. Bell's paper:—A case, invented by Miss Maling, for the growth of indoor plants; Wardian and Waltonian cases, contributed by Messrs. Barr and Sugden and Mr. Philip Palmer; vases and other ornamental receptacles for flowers, of Messrs. Minton's manufacture, contributed by Messrs. Goode; and from the Messrs. Copeland, contributed by the firm; similar receptacles ornamented with Messrs. Maw & Co.'s tiles, contributed by Messrs. W. B. Simpson and Son; a variety of receptacles for flowers, by the firm of Messrs. Hooper and Co.; also various contrivances in wire for orchids and other plants, by Mr. Holliday, of Notting-hill. Specimens of self-supporting iron window gardens, manufactured by the Coalbrookdale Company, were also shown.

The thanks of the Society are due to the various contributors.

Proceedings of Institutions.

NOTTINGHAM MECHANICS' INSTITUTION.—The twenty-seventh annual report, adopted at the general meeting of members, Jan. 30, 1865, says that the resources of the Institution have been augmented by a considerable addition of members, whilst the elementary classes are gradually attracting a large number of students. The number of works in the library is 6,921, and the number of issues during the year amounted to 33,583; 397 volumes have been purchased, 27 presented, and 44 vols. of periodicals bound—making a total of 450. Among the lectures delivered were "Chemistry of the Breakfast Table," by Dr. Gardner; "On Hood," by Mr. W. Rowton; "Modern Society," by Mr. Edmund Yates; "Thackeray's 'Vanity Fair,'" by Mr. George Dawson, M.A.; "How the English Language was formed," by Rev. A. J. D. D'Orsey, B.D. With regard to the classes, that for French has mustered an average attendance of thirty students, being an increase of two on the last year. The average attendance in the German class has been eleven. At the close of the session for 1863-4 several members of the chemistry class obtained prizes and testimonials from the Science and Art Department of the Committee of Council on Education. Dr. Wilson has reorganized the class, and the number of students is sixty-three. Dr. Wilson has also organized a class for the study of Animal and Human Physiology. This class, so far, is both popular and successful, being attended by forty-nine students. The discussion class has been discontinued. The chess class continues in the same flourishing state, numbering seventy-four members. The singing class progresses most satisfactorily, and musters between sixty and seventy pupils.

The number of ordinary members is 1,020; of honorary 122; and of life honorary 85, making a total of 1,227. The whole exterior of the building has been thoroughly repaired, at an expenditure of about £110. The Committee have under consideration plans for improving the Large Hall, by the erection of a gallery, to accommodate 330 persons. The estimated cost is about £550. Mr. R. B. Henson, who has very ably discharged the duties of Finance Secretary for ten years, retires from that office. The Committee and members heartily thank him for his services. He will be succeeded by Mr. John Thorpe, who has been a member of the Committee for some years. The Naturalists' Society have improved the Museum during the year, and some valuable specimens have been presented. About 6,000 visits have been paid to the Museum—4,000 by the public, and 2,000 by the members of the Mechanics' Institution. The receipts, in this department, including a balance of £27 19s. 5d., amount to £60 0s. 1d., and the payments to £56 3s. 7d., leaving a balance in hand of £3 16s. 6d. The general balance-sheet of the Institution shows that the receipts amounted to £792, and that there is a balance in hand of £114 7s.

NATIONAL MEMORIAL OF THE PRINCE CONSORT.

The following is an abstract of the receipts and expenditure of the Central Executive Committee, appointed at a meeting held at the house of the Society of Arts, to promote a national memorial to the Prince Consort:—

	£	s.	d.
To cash received—			
Subscriptions from her Majesty's privy purse	£550	0	0
,, the Colonies	6,912	19	7
,, Great Britain	7,142	4	11
Interest on investments	504	11	4
	£15,109	15	10
By purchase of Consols, &c.	£13,123	4	4
By brokerage	8	7	0
By advertising	789	5	0
By printing	615	13	11
By salaries	284	11	6
By postage	232	11	0
By sundries	18	17	3
	£15,072	10	0
By balance of cash in hand	37	5	10
	£15,109	15	10

Approved at a meeting of the central executive committee, the 18th day of March, 1865. Ordered that the balance in the hands of the treasurers be paid to the credit of the trustees, appointed by her Majesty, viz.:—Viscount Torrington, Colonel the Hon. Sir Charles Phipps, K.C.B., and Sir Alexander Spearman, Baronet; into whose names the above-mentioned stock has been transferred.

Frederick Byng, Chairman.

PORTUGUESE INTERNATIONAL EXHIBITION.

The programme and regulations for the International Exhibition (already noticed in the *Journal*) have now been published. The directors of the Oporto Crystal Palace Company and the Exhibition Committee have fixed Monday, the 21st of August, 1865, as the opening day. Every article produced or obtained by human industry in all countries will be admitted to the Exhibition, and classified under one of the four following great divisions:—1st. Raw materials and their immediate transformations; 2nd, Machinery; 3rd. Manufactures; 4th. Fine Arts. These four divisions comprehend 45 classes, a classification similar to that employed in former international exhibitions. Photography is included in the 4th division. The general exhibition will occupy the principal nave and aisles of the Oporto Crystal Palace. For the fine art department suitable picture galleries are provided in the body of the building. The machinery will be placed in the annexe—a temporary iron building. The space available for exhibition, and exclusive of offices of all kinds, is in the nave, galleries, and aisles of the main building, about 47,400 square feet; in the principal or machinery annexe, 30,000 feet; and in the smaller rectangular annexe, 9,250 feet. No rent will be charged to exhibitors during the time appointed for the exhibition. Rough counters and wall space will be provided gratuitously. All goods and articles for the Exhibition must be delivered at the building free of any charge to the company, and at the risk of the exhibitor, the reception of them commencing on Monday, the 15th of May next, and none will be received after the 31st of July. The most effectual means will be taken, in combination with the civil authorities, to guard against fire and protect the property of the exhibitors; but the committee cannot be responsible for losses by fire or robbery, accident, or damage of any kind. The usual regulations as to the non-admission of organic substances liable to decomposition, and of phosphorus, gunpowder, and all detonating substances, have been made. Spirits or alcohol, acids, corrosive salts, and substances of a highly inflammable nature, will only be admitted by special written permission, and must be held in well-secured glass vessels, containing not more of any of those liquid substances than half an imperial pint each; and these are to be placed in trays of lead or gutta percha, large enough to hold the contents of the glass vessels should a breakage occur. Substances liable to give an offensive smell must be properly enclosed in air-tight cases; also all substances liable to melt.

All articles exhibited will be classified without regard to nationality; but in each class the objects exhibited by one nation may be placed together. Any exhibitor whose goods can properly be placed together will be at liberty to arrange such goods in his own way, provided his arrangement is compatible with the general scheme of the Exhibition, and the convenience of exhibitors. Prices of articles exhibited may be affixed in all the divisions. These prices are obligatory, under the penalty of immediate exclusion from competition, and loss of all prizes. Exhibitors cannot remove their goods, or substitute others for them, during the period of the Exhibition, without the permission of the committee. Exhibitors may employ assistants under the usual regulations. Free admission, within certain limits, will be given to exhibitors. Steam and water power will be supplied gratuitously. Besides making arrangements for showing machinery in motion, and illustrating it by processes, the committee will reserve space (if early application is made) for the exhibition of such processes of manufacture as can be carried on without danger to the rest of the Exhibition.

All intending exhibitors must state whether they are the designers, inventors, manufacturers, importers, or producers of the articles they propose to exhibit.

Exhibitors must insure their own goods, should they desire this security.

In forwarding the goods the exhibitors will have to send with the same a memorandum in duplicate, stating the name and Christian name of exhibitor (or firm), the address, the number and weight of the packages, and the description of the articles with the price of each. On application by exhibitors, empty packing-cases will be warehoused up to the end of 1865 at a fixed scale of charges. Distinctive labels will be attached to such goods as are intended for sale, the price of which will be entered in a book, kept by an officer of the Company, through whom all sales are to be made.

No copies, drawings, or photographs of any of the works of art will be allowed to be taken without the previous consent of their respective owners. The empty

packing-cases of the fine arts class will be warehoused at the Committee's charge. No exhibitor in the fine arts class can obtain a prize, not being the author of the exhibited work. At the close of the exhibition a permanent gallery for pictures, &c., will be formed, and artists and others may leave their works on view.

In regard to foreign goods admitted to the exhibition, the exhibition building will be considered as a custom-house store, under convenient regulations proposed by the Government.

To make the exhibition more complete and attractive there will be held, from the 5th to the 13th October, an agricultural show of living animals and plants. This show will constitute—in relation to the International Exhibition—a supplementary and temporary class of the 1st division. This class will include cattle, horses, sheep, pigs, poultry, bees, silkworms, open-air plants, greenhouse plants, stove plants, fruits, and vegetables.

Medals and certificates of merit will be awarded in *all* the divisions and classes, according to the decision of a mixed international jury, partly appointed by the Council of the exhibition, and partly elected by foreign exhibitors. Each class will have an especial jury, except where several classes have a natural connection, and are slightly represented, then one jury may adjudicate on a group of several. The president of each jury will be appointed by the Grand Council; but vice-presidents and reporters in each class shall be elected by the members of the respective jury, as mentioned in a former number. Mr. P. L. Simmonds has been appointed London manager, from whom forms and all information may be obtained, at the house of the Society of Arts. Messrs. Ivens and Son, of Crutched Friars, are appointed shipping agents.

Fine Arts.

Paris Annual Exhibition of Fine Arts.—As the readers of the *Journal* are aware, the jury charged with the selection of the works for exhibition, and also with the distribution of the prizes, is elected by the whole body of artists who have received any kind of recompense at former exhibitions. The list of the artists selected for the jury of the present year shows that the recent reforms introduced by the Government in the system of fine art education are popular with the artists; the names that stand first on the jury for painting and drawing being those of the three professors of the new school of Fine Arts—Cabanel, Pils, and Gérôme. Of these M. Cabanel only is a member of the Academy of the Beaux Arts, which is directly opposed to the new governmental arrangements; of the other members of the jury, two or three are members of the Academy. M. Meissonier, who, with two other well-known artists, is elected as supplementary, is also of the Academy. It must be remembered, however, that these selections are also greatly influenced by personal feeling as well as by professional opinion. The important fact is that the juries thus elected by the whole body of honoured artists are not only with respect to painting, but in the other branches of the fine arts, perhaps as well selected as possible. All the works sent in for exhibition were received by the 20th of the present month, and the number is at least as large as it was last year. The coming exhibition may be expected to include between three and four thousand paintings and other works of art. There is one circumstance which tended to increase the number of applications this year, namely, the expectation that, in consequence of the great International Exhibition of Paris in 1867, there will be no fine art exhibition in 1866. The *salon* of the present year is expected to be beyond the average; an immense number of excellent works have been sent in, but, at the same time, there is no one work which has yet attracted the *on dits* of the artistic world of Paris. M. Cabanel, the poetic painter of the Florentine Poet, of Venus, and other well-known works, has sent a portrait of the Emperor; and M. Gérôme, instead of a Cæsar or a Phryne, contributes a Reception of the Siamese Ambassadors by the Emperor. The exhibition opens, as usual, on the 1st of May.

Monument to Claude Lorrain.—The King of Bavaria has ordered a statue of the great painter to be placed, at his own special cost, on an elevation in the environs of Munich. The formal inauguration of the work is to take place in the month of May.

Manufactures.

Industrial Exhibitions.—An act of parliament received the royal assent on Monday last for the protection of inventions and designs at industrial exhibitions. The Board of Trade may certify "Industrial Exhibitions," and the exhibition of inventions and designs at such places is not to prejudice patent rights or registration.

The Dublin International Exhibition.—On Monday last an act of parliament received the royal assent for the protection of inventions and designs at the Dublin Exhibition, to be held during the present year.

Corn Sugar.—The *Buffalo* (United States) *Commercial* states that the parties interested in the recent discovery of sugar to be manufactured from corn are actively engaged in making preparations for the extensive manufacture of sugar by the new method, and that they will shortly be prepared to put the new staple upon the market.

Ancient Paper.—The *Reader* says that Mr. Toulmin Smith, in examining a mass of rolls at the Record Office, dated 1388, made the discovery that linen paper was thus early used in England. The quality is peculiar, and is apparently an imitation of the texture of vellum. Mr. Smith, who has carefully examined the paper under the microscope, believes that he has found out the secret of its manufacture. It is as durable as vellum, and after five hundred years of very bad treatment, it has proved itself to be equally valuable for the preservation of public records. This discovery raises the question as to the date of the first paper manufactured in England.

Iron and Steel Exports.—It is a remarkable fact that while our exports of iron and wrought steel amounted to 1,494,630 tons last year, as compared with 1,640,949 tons in 1863, the value of last year's exports was £13,214,294, against £13,150,936 in 1863. It cannot be said that any material advance has been made in our exports since 1857. This is to be attributed to the stationary and, in fact, diminished demand for railway iron, in consequence of the progress now made with the great India lines and the substitution, in part, of Belgian for English railway iron in Spain.

Commerce.

The Herring Fishery.—An account of the Dutch fishery in 1863 appears in the "Annales du Commerce Extérieur," published by the French Government. The herring fishery of Holland, as regards the salt and dried fish trade, is falling off, the number of boats having diminished from 97 in 1859 to 86 in 1863. The exportation of herrings in barrels amounted to 35,089 tons, of which 21,000 were sent to Germany, more than 5,000 to Belgium, 1,450 to Russia, 3,891 to Hanover, Bremen, and the other free cities, 709 to the Scandinavian states, and 2,219 tons to the United States. The above total included, however, 16,699 tons imported, of which 15,993 tons were from Great Britain. Fishing for the fresh herring trade occupied 179 boats, which delivered in the market more than 38½ millions of fish, valued at nearly £40,000, the average price being about 18s. 4d. per 1,000.

The general decline in the sea fish trade of Holland is attributed to the ardent rivalry of the Scotch fisheries. Belgium is the largest customer to Holland; in 1863 she is reported to have purchased 30 millions of salted herrings, and 1,362 tons of fresh sea fish.

Trade with Mexico.—The exports of coal to Mexico amounted in 1859 to 3,111 tons; in 1860 to 1,965 tons; in 1861 to 4,566 tons; in 1862 to 12,776 tons; and in 1863 to 8,412 tons. The exports of wrought and unwrought iron to that country experienced great expansion, in 1863 having amounted to 8,868 tons, against 695 tons in 1862, 721 tons in 1861, 887 tons in 1860, and 271 tons in 1859. The value of the steam engines exported to Mexico in 1863 was £795, against £2,072 in 1862, and £58 in 1861. The value of other machinery, sent in the same direction in 1863, was £15,406, against £8,164 in 1862, and £7,308 in 1861.

Importation of Iron Ore into England.—An important fact, says the *Journal de Rouen*, which it is well to note, is the importation into England of iron ore from the port of Cherbourg, and brought from mines in the vicinity of that port. It appears that an annual supply of 18,000 tons has been contracted for between the proprietors of the mines and certain ironmasters of Swansea.

Artificial Fecundation of Cereals.—The Minister of the French Imperial household issued a commission some time since to examine into the system of cultivation and artificial fecundation recommended by M. Daniel Hooïbreuk. The method of effecting the latter object was by means of a line, to which a deep fringe of woollen or other material was attached; this was drawn along the heads of the wheat or other grain, at the moment when the pollen was ripe, and it was supposed, would facilitate its diffusion and adhesion. The first portion only of the report has been presented, which announces that the experiments made on the imperial farm and in other places have not produced the promised results.

Colonies.

Revenue of Victoria.—The returns for the year ending the 31st December are as follows:—The actual amount received into the Treasury during the twelve months amounted to £2,847,295 5s. 9d., which, as compared with the estimated revenue of £2,973,000, showed a deficiency on the year of £125,704 14s. 3d. The principal deficiencies have been in the income derived from public works, and in the territorial revenue. In the former it amounted to £63,824 13s. 3d., and in the latter to £84,067 16s. 1d. As compared with the previous year, however, the revenue for 1864 exhibits an increase of £129,413 13s. 2d. The financial condition of the colony, therefore, appears to be satisfactory, as it is more than probable that when the whole of the revenue for 1864 has been collected the Treasury estimate will be realised.

Gold in Victoria.—The total shipments of gold during the year 1864 were 1,686,549 ounces, the produce of this colony, and 234,913 ounces the produce of New Zealand. The annual decrease in the yield of gold is steadily maintained, being 77,487 ounces, or 5 per cent., exactly the same rate as in the previous year. The intelligence from the gold fields is satisfactory.

South Australian Statistics.—The population of this colony is now about 150,000 persons; the total value of the imports, during 1864, was £2,412,931; and the total value of the exports, £3,305,545. The public revenue during the same year amounted to £766,635 16s. 10d., and the expenditure to £612,078 8s. 7d., there being in the hands of the treasurer, on the 31st December, a total balance of nearly a quarter of a million. The receipts from customs, as well as from land sales, showed a large increase, and the revenue generally was in a most flourishing condition.

Land in South Australia.—The sales of Crown lands by public auction and private contract, from the commencement of the year 1864 to December 22, were as follows:—

Public auction,	136,063	acres	sold for	£178,981 15
Private contract,	89,511	,,	,,	90,247 0
Total	225,574	,,	,,	£269,228 15

A comparative statement of the sales of Crown lands by public auction during the corresponding periods of the years 1859 to 1863 inclusive, shows the average of the five years was 109,099 acres, sold for £144,138. The increase in 1864 over 1863 is 31,984 acres, and in value £41,883.

Salmon in Victoria appear to be progressing favourably, and the salmon fry in the River Badger are said to be in good health, and rapidly increasing in size. The news from the breeding ponds in New Norfolk, Tasmania, is favourable. The salmon and the trout have grown rapidly, and it is now believed that the fish are thoroughly acclimatised, and that the waters of Tasmania are almost as well suited to the breeding of the fish as their own native rivers.

Communication with North Australia.—Mr. Duncan McIntyre, and a friend, with three blacks, succeeded in accomplishing the journey, overland, from the Darling to the Gulf of Carpentaria, and back. This successful passage confirms the discovery made by Burke, that there is a practicable road, not only for men and horses, but for stock, right across the centre of the continent, and there can now be no doubt that nearly the whole of the interior of this vast island continent is habitable, and fit for the use of man. Even the stony desert of Sturt, so long a terror to bushmen, and a puzzle to geographers, is now shown to be for the most part a splendid sheep country. Northward of that, to the coast range, Mr. McIntyre found beautiful rolling downs, well watered and timbered. A permanent water supply exists throughout the entire route.

Railways in New South Wales.—The last of the contracts on the Southern Extension, which will carry the railway into the town of Glenburn, has been taken. The line will be twenty-six and a-half miles in length, and will comprise some very heavy works. Trial surveys have been taken of the country between Moama and Deniliquin. It is intended by the Government shortly to sell some of the land in that district, and it is also in contemplation to form a railway line in continuation of that from Melbourne to Echuca. In the event of the railways of this colony being connected with those of Victoria, a difficulty will be presented by the difference of guage—the English guage of 4 ft. 8½ in. being adopted on the railways in this colony, and the Irish guage of 5 ft. 3 in. being adopted on the Victorian lines.

Obituary.

Constant Troyon, the well-known painter of animals and landscapes, died on the 20th March. He was born at Sèvres, in the year 1810, and passed a portion of his youth in the Imperial China Works there, in painting on porcelain; but a few years of study under Riocreux, and several excursions into various parts of France, made him change his course to that in which he gained such a well-deserved reputation. He commenced exhibiting in 1833. Amongst his earliest pictures are a "Fête at Sèvres" and a "Corner of the Park of Saint Cloud;" but it was not till 1841 that a "View in Brittany" brought him into public notice. From this time he continued to gather all the laurels that the fine-art authorities of Paris had to bestow. He took the first-class medal at the public exhibitions three times, if not more, and was finally decorated with the Cross of the Legion of Honour. The number of his works must be very considerable, for he was

an indefatigable labourer. He represented nature animate and inanimate, in all her forms, and he united in a very unusual degree the powers of both a landscape and animal painter. One or more of his works are to be seen in the gallery of the Luxembourg, but perhaps his most remarkable production is a picture, exhibited four or five years since in Paris, representing a flock of sheep being driven to market in the early morning. At one time he was threatened with blindness, and a few months since a worse calamity overtook him, and he was confined in a maison de santé. He recovered his reason, but not his health, and he owed the few comforts of his latter days to a more fortunate brother artist, who enabled Troyon's mother to soothe the last few months of the painter's life in their own home. There is no French painter known who can take up Troyon's palette. His style was essentially different from that of Rosa Bonheur and her brother, and his landscapes exhibited that intimacy with and fidelity to nature which is not at all common with French artists.

Karl Kiss, the sculptor, so well known by his "Amazon" in the Exhibition of 1851, was found dead in his bed at his residence at Berlin on Friday, the 24th of March. He had suffered for some time from congestion of blood to the head, and had been long resident at Karlsbad for the benefit of the medicinal waters. The deceased professor, who was a Silesian by birth, was a member of the Berlin Academy of Arts.

Notes.

Institution of Naval Architects.—The ordinary meetings for 1865 will be held in the great room of the Society of Arts, on Thursday morning next, at 12, and evening at 7 o'clock; Friday morning at 12, and evening at 7 o'clock; and on Saturday morning at 12.

The Cologne Exhibition of the agricultural products of all nations stands adjourned to the 2nd of June, and will remain open from that date till the same day of the following month. The avowed object of the adjournment is to give English and French exhibitors the benefit of the new commercial treaty.

Industrial Exhibition.—The Society for Improving the Condition of the Labouring Classes have organised an industrial exhibition of the production of the inhabitants of model houses, which will be opened on Tuesday, April 4, at the lower room, St. Martin's Hall, Long-acre, at two o'clock, when the Earl of Shaftesbury, K.G., &c., will preside.

Agricultural Meetings.—Between this and June the following agricultural societies will hold meetings:—On the 3rd April, the Botley Agricultural Society, at Botley. On the 17th, the Royal Dublin Society holds its spring meeting at Dublin, lasting four days. On the 21st, the Wharfdale Agricultural Society, at Otley. The Ayrshire Agricultural Society, at Ayr, May 15. On the 16th May, the Stettin International Agricultural Exhibition, lasting till the 21st. On the 25th, the Royal Cornwall Agricultural Society, at Falmouth, for two days. June 3, the Royal Hungarian Agricultural Show, at Pesth, closing on the 7th. June 5, the Bath and West of England Agricultural Society's meeting, at Hereford, for four days. On the 6th, the Essex Agricultural Society's meeting, at Brentwood. On the 6th, the Guernsey Royal Agricultural Society, at the Cattle Fair Field. On the 14th, the Oxford and Banbury Agricultural Society's meeting, at Oxford. On the 16th, the Norfolk Agricultural Society's meeting, at Norwich; and on the 30th June, the Bedford Agricultural Society's meeting, at Bedford.

Correspondence.

Preservation of Food.—Sir,—In the question of South American beef, be it understood that *charqui*, or jerked beef, is one thing, *tasajo*, or salted beef, is another. *Charqui* is muscular fibre, without fat, cut into thin flakes or strips, and dried rapidly by sun heat—*i.e.*, the watery portion expelled by a hot and dry atmosphere, when it attains to the condition of glue, and will, if kept dry, last for a long period, though mites may be engendered in it like cheese. It does not lose its flavour in the process, and the mode of cooking is not by soaking, but by heating over the fire and pounding to shreds in a mortar to the condition of sausage-meat, and mixing with oil, onions, pepper, or other seasoning matter. *A fortiori* it will make nourishing soup, and there is no loss of nutriment by chemical change, as in salting. *Tasajo* is "another guess" kind of thing, prepared in climates where the air is not dry enough to take up the moisture of the flesh. So in Buenos Ayres and Monte Video fat and lean are cut into thin flakes, dipped in brine, and partially dried. This is sent to Brazil and the West Indies as a relish for the vegetable food of negroes, much like salt herrings, and the salter the better. But if this material be kept long the fat decomposes and becomes rancid. The muscular fibre loses most of its power of nutrition, and the fat becomes absolutely loathsome, save possibly to a Russian, who, it is said, prefers a rancid tallow candle to a fresh one, as an article of food. Hearing so much of South American beef lately imported as a cheap article of food, and remembering my old friend *charqui*, I was induced to procure some, and gave directions for cooking it in the best method, with no lack of appetising ingredients and flavours. But it was a material that not even a French cook could have dealt with to any purpose. The villanous substance was *tasajo*, rancid beyond my conception of any foregoing rancidity; to paraphrase Iachimo:—

> "Base and (innutrient) as the smoky light
> That's fed with stinking tallow."

It was worse than the graves that hounds are fed on; worse than oil cake that fattens bad beef. It filled the house with its wretched odour, and made my friends sick. Even the dog looked suspiciously at it as something not canny. The only method of dealing with it would have been to treat it with caustic alkali, converting the fat into soap, and leaving the salted fibre free for mixture with assafœtida, garlic, onions, shalots, or other similar matters. There has been an ingenious suggestion that it would be admirable food wherewith to feed convicts in prison. I think that if anything would deter them from crime it would be the dread of such feeding. Skilligolee would certainly be at a premium in the prison dietary compared with it. Horsebeans are doubtless a very nourishing food, and horsebeans with fresh tallow would be a delicacy compared with rancid *tasajo*. There are people who are said to like it, but possibly it was not rancid in their case. But let it be understood that the fresh *charqui*, manufactured from the mountain cattle of Chilé, of fibre and not fat, is quite a distinct thing from the salted *tasajo* of La Plata, with its rancid fat, produced on marshy plains, as different as Welsh and Lincolnshire mutton from each other. And the dry unsalted flesh would, as a nutriment, be cheaper at sixpence per pound than the moist salted at threepence. There may be nutriment remaining in the latter, but it would be necessary for the chemist to separate the noxious elements.—I am, &c., W. Bridges Adams.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Entomological, 7.
British Architects, 8.
Medical, 8.
Asiatic, 8.
Geologists' Association, 7. 1. Mr. W. H. Leighton, "On the Geology of the Isle of Wight." 2. Mr. A. Bolt, "On the Neanderthal Skull."
Society of Engineers, 7. Mr. Zerah Colburn, "On certain Methods of Treating Cast-iron in the Foundry."
Odontological Society, 8.
Royal Inst., 2. General Monthly Meeting.

TUES. ...Society of Arts, 8. Cantor Lectures. Dr. F. Crace Calvert, "On some of the Most Important Chemical Discoveries made within the last two years." (Lecture I.)
Civil Engineers, 8. Discussion upon "Drainage of Paris" and "Metropolitan System of Drainage."
Pathological, 8.
Anthropological, 8.
Royal Inst., 4. Mr. Charles Newton, "On Recent Acquisitions to the British Museum, from Rhodes, and on the Statues from the Farnese Palace."
WED. ...Society of Arts, 8. Professor John Coleman, "On Food for Cattle."
Geological, 8.
Pharmaceutical, 8.
THURS...Royal, 8½.
Antiquaries, 8.
Linnæan, 8. 2. Mr. R. M. Redhead, "On the Flora of the Desert of Sinai." 2. Mr. B. T. Lowne, "On the Vegetation of the West and South Shores of the Dead Sea."
Chemical, 8.
R. Society Club, 6.
Artists and Amateurs, 6.
Royal Inst., 4. Mr. Charles Newton, "On Recent Acquisitions to the British Museum, from Rhodes, and on the Statues from the Farnese Palace."
Inst. of Naval Architects. Morning Meeting, 12. Evening Meeting, 7.
FRI.......Royal Inst., 8. Dr. A. W. Hofmann, "On the Combining Power of the Atoms of the Elements."
R. United Service Inst., 3. Captain C. C. Chesney, R.E., "Lessons from American Campaigns."
Inst. of Naval Architects. Morning Meeting, 12. Evening Meeting, 7.
Philological, 8.
Archæological Inst., 4.
SAT.......Royal Inst., 3. Prof. Marshall, "On the Nervous System."
R. Botanic, 3¾.
Inst. of Naval Architects. Morning Meeting, 12.

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 11th and 13th March, 1865.*

60. Bills—Married Women's Property (Ireland).
61. ,, Perth Provisional Order Confirmation.
62. ,, Qualification for Offices Abolition (amended).
66. ,, Railway Travelling (Ireland).
3 (350 to 257). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 250 to 257).
35. Calendar of Patent and Close Rolls (Ireland)—Report by Messrs. Brewer and Hardy.
55. Gas Companies—Return.
66 (III). Railway and Canal Bills—Fourth Report of the General Committee.
102. Navy Estimates—Memorandum of Proposed Changes.

SESSION 1864.

547. Uxbridge Yeomanry Cavalry—Correspondence.
550. Canada—Correspondence.

Delivered on 14th March, 1865.

65. Bills—Charitable Trusts Fee.
67 ,, Isle of Man Disafforestation (Compensation).
3 (258 and 259). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 258 and 259).
65 (III). Committee of Selection—Fourth Report.
68. East India (Calcutta)—Report, Papers, and Correspondence.
114. Thames Conservancy—Report of Mr. W. H. Leach.
117. Clonpriest, &c. Benefices—Return.
118. Tralee Election—Return.

Delivered on 15th March, 1865.

58. Bills—Local Government Supplemental.
70. ,, County Voters Registration (Ireland).
77. Queen Anne's Bounty—Account.
119. Steam Vessel "Stanley"—Report and Evidence.
Merchant Vessels (Straits of Gibraltar)—Declaration of British and Spanish Governments.
Brazil—Correspondence respecting Hostilities in the River Plate, &c.

Patents.

From Commissioners of Patents Journal, March 24th.

GRANTS OF PROVISIONAL PROTECTION.

Bales, hooping or binding—628—W. Riddle.
Bottles, stoppers for stopping—646—G. Ireland.
Buttons, manufacture of—594—W. Clark.
Chemical solutions, apparatus for impregnating wood with—590—W. E. Newton.
Corn, machinery for grinding—652—F. W. Turner.
Fabrics, manufacture of—563—D. Chalmers.
Files, machine for shaping—616—T. Turton.
Furnaces, smoke consuming—3255—P. A. Roger.
Hair, apparatus for brushing—343—J. B. Watters.
Iron forgings, manufacture of—654—W. Clay.
Lace, manufacture of—608—H. Taylor.
Lamps, reflecting apparatus for—342—R. De Bray.
Looms, circular box—489—J. Keighley and R. Shepperd.
Machine, sewing and other—334—H. Masters.
Metals, apparatus for cutting and shaping—644—J. and J. Wadsworth.
Oil and coke, apparatus for producing—500—J. Nicholas.
Oils, extracting gases from—549—W. Sim.
Omnibuses, arrangements of—586—J. Kirkland.
Photography—3048—C. A. Martius.
Pots and crucibles—630—G. Nimmo.
Pumps—620—R. A. Brooman.
Railway carriages, protecting the buffers of—626—W. J. Oliver.
Railway train, communication with the guard of—530—G. Score.
Railway trains, communication between passengers and guard of—545—F. Dancart.
Sheep shears, manufacture of—612—W. Clulow.
Ships, prevention of fouling on bottom of—624—F. Cruickshank.
Signalling apparatus—553—J. Blackie, jun.
Smoke consuming apparatus—584—S. and E. Hopkinson.
Spinning, mules for—577—J. Dodd.
Stables, partitions for—610—L. le C. Cottam.
Steam generators, joints for—582—J. M. Hetherington.
Stopping bottles—606—J. H. Johnson.
Tyres, steel railway—614—J. Whitley.
Tubular boilers—634—R. A. Brooman.
Water-closet apparatus—648—J. Shanks.
Watches, protection of—2870—J. Sheppard.
Wire fences—592—R. Johnson.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Mirrors, manufacture of—786—J. H. Johnson.
Paper collars, cloth-lined—769—S. S. Gray.

PATENTS SEALED.

2363. J. Hill.
2368. W. H. Orth.
2370. R. A. Brooman.
2373. K. H. Lane.
2375. J. Lister.
2386. H. A. O. Mackenzie.
2388. C. W. Allen.
2395. S. Alley.
2399. G. Allix.
2401. G. Lindsley.
2407. A. A. Croll.
2414. W. E. Newton.
2415. W. Clark.
2470. W. Clark.
2483. R. M. Hands.
2494. E. H. Huch and F. Windhausen.
2511. J. Moller.
2541. W. Clark.
2685. J. L. Norton.
3184. R. L. Howard and J. Daghlish.

From Commissioners of Patents Journal, March 28th.

PATENTS SEALED.

2400. R. A. Brooman.
2402. G. H. Harrington, H. and F. Y. Hewetson.
2410. W. H. Graveley.
2418. P. Winton.
2422. J. H. Johnson.
2423. F. N. Gisborne.
2432. R. Laming.
2440. T. Dobson.
2446. H. A. Bonneville.
2449. J. O. Communay.
2465. P. A. Le Comte de Fontainemoreau.
2471. G. Davies.
2555. F. A. Calvert.
2596. W. E. Newton.
2613. J. G. Jones.
2656. P. A. Le Comte de Fontainemoreau.
2677. H. A. and J. E. Jowett, and J. B. Muschamp.
2763. G. P. Harding and L. Thomas.
2786. W. E. Newton.
2896. J. Easton, jun.
3006. W. Clark.
3087. A. Pemberton and J. Ford.
3088. A. V. Newton.
185. A. I. L. Gordon.
229. J. G. Willans.
244. J. H. Johnson.
2906. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

802. J. G. Jennings.
844. W. Greenway.
966. W. E. Newton.
1034. C. Bartholomew and J. Heptinstall.
806. G. Hartshorne, jun., D. G. Ward, and W. Woolley.
828. W. Clissold.
915. H. W. Caslon and G. Fagg.
919. H. J. Madge.
940. G. Bower and J. Qualter.
988. J. Watremez and A. Kloth.
1192. W. Haggett.
815. E. Morewood and A. Whytock.
825. E. Morewood and A. Whytock.
967. W. E. Newton.
813. B. Fleet.
817. J. Stewart.
830. L. De La Peyrouse.
859. W. F. Smith and A. Coventry.
901. J. M. Clements.
822. A. Fryer.
854. R. De Bary.
994. J. Whitehouse.
829. J. T. Loft.
873. Y. Parfrey.
875. I. Morris.
939. R. Morton.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

662. J. Horton.
605. W. E. Wiley.
633. W. Richards.
628. J. Nuttall.
1725. T. Webb and J. Craig.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, APRIL 7, 1865. [No. 646. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

April 12.—Passion Week. No Meeting.

April 19.—"On the Preservation of Natural History Specimens for Museum Purposes." By B. Waterhouse Hawkins, Esq., F.G.S.

CANTOR LECTURES.

There will be No Lecture on Tuesday evening next.

Proceedings of the Society.

CANTOR LECTURES.

The first lecture of Dr. Crace Calvert's Course was delivered on Tuesday evening, the 4th of April. During the vacation the complete course of lectures, corrected and amplified by the author, will be published in the *Journal.*

EIGHTEENTH ORDINARY MEETING.

Wednesday, April 5, 1865; Edward Holland, Esq., M.P., in the chair.

The following candidates were proposed for election as members of the Society:—

Bourne, Geo. S., R.N., Royal Hospital, Greenwich, S.E.
Brackenbury, Capt. C. B., R.A., 1 Adelaide-place, Woolwich-common, S.E.
Brady, Francis, 12, Limes-villas, Lewisham, S.E.
Brumleu, Charles, 6, St. John's-road, Brixton, S.
Burt, C. J. T., Roadside, West Hill, Putney, S.W.
Clark, Edward, 2, Rose-villas, Montpelier-road, Peckham-rye, S.E.
Cotterill, W., Norbiton-park, Kingston-on-Thames, S.W.
Danby, Thomas, 7, Parliament-street, S.W., and 31, South-grove, Peckham, S.E.
Dolan, H., Park-hill, Clapham, S.
Eden, Frederick Morton, Capel-house, Kew, W.
Farnall, Harry Barrard, Poor Law Board, Whitehall, S.W.
Field, Hamilton, Clapham-park, S.
Folkard, Augustus, Haslam-house, Lewisham, S.E.
Gibson, John, 1, Era-place, Surrey-lane, Battersea, S.W.
Goodwin, Rev. Thomas, M.A., Croom's-hill, Greenwich, S.E.
Gowan, George D'Olier, Wood-lawn, Dulwich, S.E.
Graham, John, 74, Manor-street, Clapham, S.
Harker, George, Uplands, Sydenham, S.E.
Harrison, C. Wrightman, Pneumatic Loom Company, 26, Lombard-street, E.C.
Hawley, Henry J., 4, Foxgrove-road, Beckenham, S.E.
Herapath, John, Catford-bridge, Lewisham, S.E.
Hills, F. C., Denmark-hill, S.
Hoblyn, Thos. Hallam, Rickling, Bishop's Stortford.
Holloway, William, 4, Park-road-villas, Battersea, S.W.
Hosegood, Thomas W., Rosendale-villa, West Dulwich, S.
Jerram, E. J., 3, Cedars-road, Clapham-common, S.
Johnson, John G., Assay-office, 18*a*, Basinghall-st., E.C.
Legg, George, 61, King William-street, E.C.
Lewis, Thos., Somerset-lodge, 35, London-rd., Croydon, S
Lord, W. B., 37, Stockwell-park-road, Brixton, S.
Macandrews, J., Roehampton-lodge, Roehampton, S.W.
McArthur, W., 1, Gwydyr-houses, Brixton-rise, S.
Martley, W., 15, Cedars-road, Clapham-common, S.
Menge, Rev. J. P., Electrical-hall, Park-villas, Lower Norwood, S.
Milnes, William S., 11, Devonshire-road, Greenwich, S.E.
Monk, J. C., 3, Manor-road, Wallington, S.
Moren, George, 38, Threadneedle-street, E.C.
Painter, Henry, 1, Arlington-villas, Loughborough-park, Brixton, S.
Papengouth, Lieut. Oswald C., 12, Bloomsbury-sq., W.C.
Price, Charles J., Carlton-chambers, Regent-street, S.W.
Tefft, Benjamin F., LL.D., 31, Upper King-street, Holborn, W.C.

The following candidates were balloted for and duly elected members of the Society:—

Booth, Captain John, 21, Kensington-crescent, W., and Conservative Club, S.W.
Chatwood, Samuel, Lancashire Safe and Lock Works, Bolton.
Good, Joseph Henry, 21, Upper Hamilton-terrace, N.W.
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The Paper read was—

THE FOOD OF ANIMALS.

By Professor John Coleman.

The subject which I have undertaken to introduce this evening is one of great importance, not only to those im-

mediately interested, but to the public generally, as an economical method of feeding must influence the price of meat. The tendency of English agriculture is towards an increase of live stock, and therefore anything relating to their management should be interesting. Great progress has been made in the management of fatting animals during the last ten years. Practices have been established, founded on more correct knowledge of physiological principles. Contrast the present system of cooking food—of mixing a variety of substances natural and artificial, and the use of the pulper and chaff-cutter, with the ancient practice of allowing a beast to fill himself with sliced roots and hay *ad libitum.* Still, there is room for improvement. Farmers are too often satisfied to carry on their business as they have learnt it, without testing their practice by reason and science; and shut their ears, as it were, to the valuable advice from time to time advanced by scientific men. The subject is, moreover, peculiarly interesting after such a season as the past, which has been remarkable for the deficiency both of roots and hay—an unusual event—for we have frequently suffered in one or other of these important products; the weather which proved injurious to the one having favoured the other. Both being deficient, our prospects last autumn were gloomy indeed, and now that the trial is partially over, we may congratulate ourselves that we have got through the winter so well. The evil has not been unmixed with good. Necessity, the mother of invention, has led to shifts and plans, in carrying out which important experience has been gained, to bear fruit in a more economical management hereafter. And although I do not anticipate that in ordinary seasons cattle will be fed, as a rule, without roots, I am certain that a smaller proportion will be found sufficient; and, consequently, a considerable saving will be effected in this costly produce. The value of well-made straw as food has been over and over again insisted upon; yet it needed such a season as the last to carry conviction to the sceptical. In future we may hope that more straw and less hay will be cut up; less roots, and more corn and artificial food used. I propose to consider the subject under three heads:—

1. Natural food—such as root crops, hay, and straw.
2. Artificial foods—grain.
3. The best means of using these materials.

The animal body consists of three descriptions of material, skin and flesh, fatty matters, and the bony structure, made up of nitrogenized, non-nitrogenized, and mineral substances, all of which must be supplied in the food. Now Mr. Lawes has found that the ox, the sheep, and the pig are composed of different proportions of these substances, and that the proportions vary in the same animal, according as it is in store or fat condition; that, as the animal becomes ripe, the proportion of nitrogenous, mineral matters, and water is reduced, whilst fat (non-nitrogenous substance) increases largely; thus the ox contains 18 per cent. of nitrogenous material in a store state, and only 15 per cent. when fat; 16 per cent. of non-nitrogenous compounds in the animal is increased to 30 per cent. when fat, whilst mineral matters recede from 5 to 4 per cent., and water from 60 to 51 per cent.

Most vegetables in a ripe state, and when grown under proper conditions, are composed, in differing proportions, of a flesh-forming material, a heat-producing substance, and some mineral matter, required for the bones and juices. A large proportion of all vegetables consists of starchy materials, or digestible fibre, whose use in the animal economy may be likened to the fuel which supports ordinary combustion; it is taken into the blood, and then slowly burned, producing heat, so necessary for the preservation of animal life. The amount of fuel required depends upon the description of animal, and the exposure to or protection from cold. If we have an excess of such material, it is partly accumulated as fat. A great distinction is however to be made between starch, sugar, and digestible fibre, and the vegetable oils, which are almost identical in composition with fat. Mr. Lawes concludes, from his experiments, that starch, cane sugar, and probably digestible fibre, have, weight for weight, nearly equal feeding qualities, whilst fat and oil have probably about 2½ times the value of those materials, for the purposes of respiration or storing up fat in the system.

Root Crops.

The Swede.—According to Dr. Voelcker, the bulb contains about 88 per cent. of water and 12 per cent. of solid matter, consisting, in round numbers, of—

Flesh formers	2	parts
Sugar, gum, starch............	1½	,,
Vegetable fibre (digestible)	5½	,,
Mineral matter	3	,,

The mineral matter is of great importance, containing all those salts required in the tissues and bony system. Thus in the whole plant we find a large proportion of the ash to consist of potash, phosphate, and sulphate of lime, and common salt. It is calculated that a crop of twenty tons of swedes robs the soil of about 500 lbs. of mineral matter, which must be returned to the soil, either by sheep feeding or a direct application of manure. Turnips and hybrid varieties differ from the swede only in containing more water, and therefore less solid matter. It will be seen that the root crop is, for a given bulk, not particularly nutritious; the experience of the past season proves that it may be to a great extent replaced by other materials; and I do not hesitate to state that an unlimited supply of roots is often very injurious. The nutritive qualities of roots depend upon their condition; like all other vegetables, they pass through different stages of growth, and if consumed before being properly matured, or grown on soil that is not properly enriched, they are not only un-nutritious, but frequently prove injurious. Who has not remarked the severe losses in young sheep when first put on swedes in a growing season, and when the plants are in a very fresh state? This is due to the unripe condition of the crop, producing violent disturbance of the digestive system; in fact, just the same result as if we eat unripe fruit.

These unmatured roots are found to be deficient in gum and sugar, and to have an excess of nitrogen. As a proof of the correctness of this view, it may be noticed that the locust bean, a food very rich in sugar, has been found to arrest this dangerous scour. Recent examination has proved that all food in an unripe and unhealthy state contains more nitrogen than when ripe, and now, the proportion of sugar, gum, &c., is a surer test of value. Some very important practical considerations arise from these facts. Root crops should not be consumed until they are fully ripe, and hence it follows that early-planted well-grown turnips will do for animals better, at a certain time, than swedes. Land that is undrained, or supplied with an excess of manure, will not mature its crops; and, lastly, swedes and mangolds will, as a rule, be greatly improved by storing for a few weeks, as the ripening process goes on rapidly in the heap, and there is a considerable increase of sugar and soluble materials. It will be remembered that there was a time, comparatively recent, when our scientific authorities believed that the nutritive value of food was dependent upon the proportion of nitrogen present. Now we know that an excess of nitrogen is a proof of an unhealthy condition, and that whilst a certain portion of flesh-forming material is highly important, it is the proportion of gum, sugar, starch, and digestible fibre that really determines the nutritive qualities. In wet, cloudy seasons, when there is an absence of direct rays of the sun, we must be especially careful how we consume our roots. The eating a large bulk of such raw material, unqualified by sugary or oily food, will prove most prejudicial. For all these reasons I recommend the storing of roots whilst they are in a comparatively growing state; the moderate use of farm-yard and other highly nitrogenous manures to the root-crop, and their complete mixture with the soil, where practicable, instead of the old plan of placing such

material immediately beneath, and in close contact with, the crop; and, above all, storing for a few weeks before using. There is, moreover, economy in this latter practice, as regards all crops to be consumed in the winter and spring, for if left exposed in the soil the proportion of woody matter continues to increase at the expense of the starch, &c.

Mangolds are a most valuable root in the southern and drier countries of England, but seem unsuitable for the moister climate of the north. The crop requires heat in order to mature. According to Dr. Vœlcker, the mangold bulb consists of 86·04 water and 13·96 dry matter, which latter is made up of—Flesh-formers, 1·81; heat producers, 11·19; mineral matters, ·96. As a general rule, the mangold is not fit to eat until it has been stored for some months, but this entirely depends upon the soil and the season. On porous, well-cultivated soils, the mangold crop last year was much more suitable for immediate use in November than the swedes, which were growing fast, whereas the mangold, in consequence of the hot, dry summer, had matured its sugar, and in many instances it was eaten on the ground, and the stock did remarkably well. After a wet autumn—on the contrary—the mangold would prove most unwholesome, and would, in all probability cause the animals to scour, and do them harm instead of good. This is generally the case, and as the root possesses excellent keeping properties, I advise storing and not beginning to consume until the end of February or March. So nutritious is a well-kept mangold that I have seen stock sows quite fat from eating this root. The use of salt as a manure for mangolds has been constantly recommended, though I know of no very conclusive experiments. The mangold is derived from a seaside plant, and its ashes contain a considerable proportion of salt, but the indiscriminate use of salt is very dangerous; on all strong soils it will do harm, as it retards growth, whereas on warm, quick sands and gravels, by checking growth, salt does good, as there is a tendency under such conditions to return to the original annual state, and we see many of the plants running to seed. Salt will probably check this, and four to five cwt. per acre sown broadcast will be likely to do good. No stock farmer should be without a few acres of mangolds, to be kept in reserve against a backward spring; they are then invaluable and are never in the way, for if we have abundance of grass, &c., a few cut up will make an agreeable change.

In our short notice we must not omit the *cabbage*, which on all rather strong, well-cultivated soils, is a most valuable crop. According to Dr. Voelcker, we have much less water in the outer leaves than in the inner leaves and heart; thus he found in outer leaves only 84 per cent., whilst the heart and under leaves contained 89 per cent.; the average proportion of gum sugar is about 7 per cent., and rather less than 1 per cent. of ash. The cabbage is found useful for all kinds of stock, and, whether for the production of milk or fat, is a valuable food. It is expensive to grow, and requires plenty of manure, but coming in during the summer and early autumn is of great use, as we are then often short of, or at any rate, want a change of food. It may also be grown as a winter crop, and stands frost well.

Rape is a crop that on peculiar soils—such as the peaty soils of Lincolnshire, the marls, and strong soils generally that contain lime—does well and affords much valuable keep. The soil should be well tilled and in a highly enriched condition—the climate rather moist and warm. From the large amount of nitrogen compounds and starchy matters ($11\frac{1}{2}$ per cent.) that the rape contains, we can readily understand that the nutritive qualities of the crop greatly depend upon favourable conditions, and such is the case. In a wet, cold season, or if eaten off at a wet time and whilst in a very growing state, rape proves unhealthy food, causing scour; and I should recommend that sheep be gradually introduced to this succulent crop, and never allowed to consume it without a good supply of dry food to act as a corrective.

Grass and Hay must not be omitted from our notice, as forming so considerable a portion of all natural produce. Hay made from good sweet land, consisting of a variety of grasses, is the best possible food we can use; and more milk, and possibly as much beef, will be made from an unlimited supply of good hay and water as by any other mode of feeding. But we cannot afford to use hay in this way; we must keep an increased stock, and we find that hay is often a very expensive food, inasmuch as laying up the land for it curtails the summer stock, and frequent mowing weakens the land. The feeding value of grass depends in a great degree upon the presence in the soil of those mineral substances which the better grasses require; a variety of different grasses and leguminous plants are then encouraged, which, from their various qualities, form a mixture highly suitable to the digestive process, and also are of regular and slow growth. I do not doubt that an examination of our best grazing land would exhibit a great variety of grasses, and I am quite certain that very rapid growth is undesirable. This, to some extent, is the reason why water meadows and sewage grass are comparatively so weak. The grass is forced too rapidly to become properly matured, and the excessive rankness of certain descriptions which rejoice in an excess of moisture, keeps in check other kinds of grasses, and hence the produce is more simple than that of natural upland grass. These facts, whilst they may not, under certain circumstances, militate against water meadows or sewage, point out that whilst animals are on such food, we should do well to supply artificial matters containing sugar or oily materials, to counteract the excessive quantity of nitrogen which such food invariably contains. Mr. Lawes' experiments at Rugby lead him to the same conclusion. One of the oxen fed there was considerably lighter after having his fill of sewage grass for many weeks, and all the animals did badly. But when 4 lbs. a day of linseed cake was added to the grass, the improvement was visible and satisfactory. Sewage grass is better adapted for milk cows than for any other descriptions of stock, but even with them it will not do well alone: it is too watery. I have seen ewes and lambs on the water meadows in early spring doing very badly with abundance of grass, especially if the weather has favoured a rank growth; and I cannot condemn too strongly the practice of thus feeding sheep without some dry and nutritious food. Undrained land, again, favours the growth of coarse watery grasses, which seldom can be properly matured. Hence the pasturage is always inferior, although the actual bulk of produce may in some instances be found to exceed that from the same land when drained. In most cases where rot in sheep, splenic apoplexy in cattle, and other diseases of the liver and digestive systems occur, the grass will be found unmatured, and containing an excess of nitrogen.

Well-made hay from good dry pastures is without question very valuable food, and food that I strongly recommend, provided it is not too costly, which at the present day, with our resources, we believe it frequently proves. According to Dr. Voelcker, good meadow hay contains more oil, fatty matters, and sugar, but less flesh-forming materials than that from artificial grasses, and both are superior to straw. Hence the value of a portion of hay for young growing animals. But with the aid of artificial food, straw may be largely substituted for hay, both for feeding and growing stock. And this is one of the great improvements of feeding in modern times, well deserving of most serious attention. The nutritive value of straw depends upon the condition and nature of the soil and climate. Some land will produce much more nutritive straw than other land, depending upon the process of harvesting adopted and upon the description of straw, the last stages of ripening, or, more correctly, of over-ripening, consisting in the change of soluble to insoluble matters. You will see, by examining the table, that the total

amounts of different ingredients do not differ materially between the fairly ripe and the over-ripe straw, but the condition in which the ingredients exist is widely different.

Composition of Oat Straw, and Hay.

	Oat Straw cut green.	Oat Straw fairly ripe.	Oat Straw over ripe.	Clover Hay.	Meadow Hay.
Water	16·00	16·00	16·0	20·50	16·66
Oil	1·57	1·05	1·25	3·59	5 01
*Soluble protein compounds	5·51	2·62	1·29	5·00	1·81
†Insoluble do.	2·98	1·46	2·36	8·75	6·25
Sugar, gum, and extractive matters	16·04	10·57	3·19	13·07	15·98
Digestible fibre	26·34	30 17	27·75	16·42	28·88
Indigestible woody fibre	24·86	31·78	41·82	25·62	17·64
Soluble mineral matters	5·76	3·64	2·26	4.43	4·37
Insoluble mineral matters	·94	2·71	4·08	2·62	3·40
	100·00	100·00	100·00	100·00	100·00
*Contain nitrogen	·88	·40	·20	·80	·29
† Do. do.	·47	·23	·36	1·40	1·00
Total	1·35	·63	·56	2·20	1·29

10 per cent. of sugar has become reduced to 3, and other changes have taken place, principally in the proportion of soluble and insoluble woody fibre. It may be asked naturally, whether, by cutting our crops before they become fully ripe, the grain does not lose weight or bulk. I answer not, if cut at the proper time, which practical experience can alone decide. Wheat and oats are now cut in a much greener state than formerly, and it is found that the sample is brighter, contains less bran, and is quite as bulky, considering that there is little or no loss from shedding, and in the case of a wet season, greater power to resist the action of moisture. From the table, it is clear that the very green sample, cut some twenty days before the period of dead ripeness, contains matters that should have gone into the grain. About ten days to a fortnight before dead ripeness is the best time to cut oats, when some of the bell has turned yellow, and the straw is partly turning. I have cut white oats so green, that when lying in swarth, they looked almost like grass, and I feared the sample would contain green corn, but it turned out a beautiful bright colour, weighing 45 lbs. per bushel. It is evident that, in the case of oats more especially, the grain feeds from the straw after it is cut. The materials remain in a soluble condition, and the straw is doubled in feeding value. The difference in value of different kinds of straw is so considerable as often to influence our choice of crops.

Pea and bean straws are both valuable, especially the former, which, when cut moderately green and harvested without wet, is often equal to poor hay, and will be eaten with great avidity by all kinds of stock. Beans contain more woody matter and require to be more fully ripe, therefore are less nutritious; still, the upper portions and the pods form excellent food, and I have seen ewes, especially during severe weather, kept in capital condition with bean straw and a minimum quantity of turnips. Oats come next in value, and every handful of such straw, when sweet, should be passed through the animal's body. The waste that we too often see from the straw being left unthatched is deplorable; the first rain soaks in and damages a large quantity of valuable food. It should be taken as much care of as hay. Barley straw is mechanically suitable for food, and does well to mix with harder materials; but, being generally cut dead-ripe, there is but little soluble matter, and I consider it as the least valuable of our straws. Wheat straw has been much used during the past season, and when cut green and mixed with oat straw it makes good chaff. Still, it is too harsh to be used in large quantities; we should expect irritation of the mucous membrane from too much of such dry material. One great point gained by the use of straw in place of hay is the increase of spring and summer food—both on the pasture land and artificial grasses—and this is most important, as it enables us to keep a heavier stock during the summer, a great difficulty on many light-land farms. In Lincolnshire, so justly celebrated for its farming, they hardly make any hay at all, the seeds being folded off by ewes and lambs. The use of straw, chaff, and pulped roots, in place of long hay and sliced turnips, is one of the great improvements in modern agriculture.

Having thus briefly alluded to the natural produce, more especially grown for stock food, we pass on to consider the various materials extraneous to the farm, which are now brought within reach of the farmer. Whilst our corn produce keeps at the present low rates, it is decidedly a good economy to pass a considerable portion through the animal's body—make our produce walk to market, as the saying is. At the same time, in order to feed economically, we must add to such food other materials, because they contain ingredients which are of great use in feeding, and which our own grain is deficient in, and, moreover, experience has proved that a mixture of different materials is highly desirable.

Linseed Oil Cake has been employed to a far larger extent than any other artificial food, and has risen greatly in value; nor is this the only difficulty. The ignorance as to what a really pure cake should contain, the absence of all analytical tests, and the stimulus of keen competition, has led to the sale of vast quantities of rubbish, containing, with some linseed, a mixture of all sorts of weeds, some actually injurious, and all inferior in feeding qualities. Attention has been lately called to this subject. The farmer has been told, in the clearest language, what a good cake should contain, and by a payment of five shillings any member of the Royal Agricultural Society, if he fears his own judgment, can obtain an opinion as to the genuineness of the article. Many avail themselves of this privilege, but it must be confessed that there are difficulties in the way of obtaining a pure cake, for which the crushers are not altogether responsible. The seed seldom comes clean, and if the 10 to 15 per cent. of dirt and weeds is screened, the crusher must have an extra price for his cake, and this the farmer will seldom give; he is too fond of a cheap article, and looks at the saving of £1 to 30s. a ton, rather than to the actual value of the two samples. The manufacturers must supply the demand; they cannot control it, and if they find that for every ton of pure cake they can sell ten of ordinary kind, they will naturally make that article which pays them best. Many attempts have been made by crushers to supply a perfectly pure cake, but on the whole such attempts have not met with the encouragment they deserve. When seed is dear, a variety of foreign matters are introduced, in order that a cheap cake may be produced. Thus, ground earth nuts, palm nut kernel cake, from Hamburgh, &c., have been introduced into Hull and other places. The difficulty of getting a really good cake has induced a company of farmers in Yorkshire to start a mill, and make their own cake from good screened seed. But it has not hitherto been found a very profitable arrangement. Good linseed cake, made from East Indian seed, should exhibit a red seed, and, upon analysis, should yield from 10 to 13 per cent. of oil, 28 per cent. of flesh-forming constituents, and not more than about 15 per cent. of insoluble woody fibre, with about 6 per cent. of mineral matters; the latter particularly rich in potash and phosphoric acid, which partly explains the high value of manure from animals eating oil cake. Foreign cake, especially such as was imported from New York before the war broke out, was preferred by many as being drier and freer from impurities; latterly, however, the samples have not been so good, whilst French and German oil cakes vary greatly, and are not, on the whole, to be depended upon. Linseed cake is an exceedingly valuable material, being

readily eaten by all descriptions of stock, and containing in good proportion the flesh-forming, the heat and fat-producing, and the bony food. The oil is not of the most fattening nature; indeed, in excess, its action is purgative, but when diluted with an equal quantity of meal from grain, this is not felt to be an objection; indeed, it may be perhaps advantageous, as it ensures a healthy condition of the bowels. The large proportion of flesh-forming matters renders linseed cake particularly suitable for young growing cattle. It is, however, a very costly article at the present time, and I think we may lay down a very general rule that whenever good linseed cake exceeds about £9 a ton we must consider how far we can find cheaper materials to take its place. Fortunately, linseed is not our only source of feeding vegetable oil. Of late years, large quantities of other materials, such as rape, cotton seed, and palm nut kernels, have been introduced, and have, in many instances, successfully taken the place of linseed cake.

Cotton seed cake has been and is used to a large extent. Before the American war New Orleans supplied us with a considerable amount, in a decorticated state, that is, free from the greater portion of its hard, indigestible shell. In this state cotton cake was a very valuable article, nearly, if not quite, equal to linseed cake. Now, the quality is very various, and the best contains so large a proportion of woody fibre, that I do not consider it so desirable as many other kinds of food. In selecting cotton cake, choose that which is finely ground, and yellow in colour; this is less indigestible than the black, coarse-ground cakes which we frequently meet with. Several instances of death from the use of bad cake might be quoted. The indigestible shell accumulates in the third stomach, causing inflammation. I think cotton cake unsuitable for young animals, both on account of the shell and the portions of cotton which are frequently found in it. The analysis of three samples, by Dr. Voelcker, gives an average of—

Moisture	11·34
Oil	6·18
Flesh-formers	23·72
Gum, sugar, &c.	30·98
Woody fibre	21·24
Mineral matter	6·54
	100·00

The large amount of ash, which, like linseed, is rich in potash and phosphoric acid, points out cotton cake as likely to influence the value of the manure, as we find that Mr. Lawes, in his theoretical comparison, places it at the head of the list. Samples of cotton cake, with from 25 to 40 per cent. of woody fibre, are occasionally met with. Such food must be highly indigestible. Fine grinding is a point of great importance. A good sample is now worth £5 10s, to £5 15s. a ton, and at such a price will be found economical for growing stock, not too young.

Rape Cake when pure is a valuable food, and deserves a more extensive use. English cake, made principally from East Indian seed, is inferior to German cake, since the cultivation is not so clean, and the seed is adulterated with wild mustard, charlock seed, &c., and, as all these seeds are of the same shape, it is impossible to separate them. Instances have occurred of animals having been poisoned in consequence of the large admixture of wild mustard, which acts as a violent irritant on the mucous coat of the stomach, producing inflammation. I do not mean to infer that good rape cake is not made in England, because clean seed is obtained from the Continent; but, as a rule, the green German rape cake is very superior, and commands usually £1 a ton more than English. The principal objection to rape cake is that its strong, pungent flavour is objected to by cattle, and patience and time are required in order to bring animals to take to it. New cake especially should be avoided, as it loses some of its pungency by age. Some recommend boiling or steaming the rape, for an hour, which destroys the oil of mustard, should any exist, and renders even good cake more mild and palatable. I have known it thus treated and poured over chaff with success. Such a mixture would do well for straw yard cattle. The following anecdote shows how completely animals are, like ourselves, creatures of habit:—Some years since I was feeding two home-bred steers upon linseed cake and meal. In early life, and, indeed, until the fattening process commenced, they had received a small quantity of rape cake, which was replaced by oil cake, as they had become fat. The cowman one day gave them a piece of rape cake, and finding it eagerly consumed, introduced a little, and to his surprise found that they liked it decidedly better than the linseed, and accordingly they were finished off on rape cake. Their tastes had been cultivated to prefer the bitter, hot rape cake to the mild, pleasant linseed cake. So if we begin with young animals, we shall soon teach them to eat it. The best green German rape is worth £6 10s. to £7 a ton. Alderman Mechi is a most consistent advocate of rape, using, I believe, English cake; he believes it to be equally as feeding as linseed cake, at a greatly reduced price.

Palm Nut Kernel Meal.

This comparatively new feeding material is produced from the palm nut kernels, which are ground up, and a portion of the oil expressed; formerly this kernel, which is encased in a hard shell, was thrown away as valueless, the orange coloured flesh of the palm fruit being the portion from which alone the crude palm oil was obtained. It is now some five years since Messrs. A. M. Smith and Co., of Liverpool, were induced to try a few tons of kernels. The hard shell is removed by natives in Africa, who break it off with a hammer. The kernels vary in size from a hazel to a filbert. After being reduced to powder, they were treated very much the same as linseed; a valuable oil results, and the meal which remains still contains, according to quality, from 20 to 25 per cent. of a beautiful fatty matter. At first it was found difficult to find a market for the meal, and it is on record that some of the first made was thrown away. It was soon found that pigs grew fat on it, and a sample reached Dr. Vœlcker, who found it contained materials that should make it a very valuable feeding substance; subsequent experience has fully confirmed the accuracy of this view.

Until the spring of last year the supply of kernels was too irregular to allow of a fair trial being made or the meal becoming generally known. Several farmers, however, used it with success. I myself was the first to try it, and, after a little trouble in accustoming the stock to eat it, found it so valuable that upwards of 30 tons were used in a little over two years. Last year arrangements were entered into to secure an abundant supply of kernels. The matter was then brought before the public, and so active has been the demand that Messrs. Smith have had as much as they could do to supply orders. Palm-nut meal is a gritty meal, of a brownish-white colour, with black specks, which are portions of the skin of the nut. The fatty matter may be seen by rubbing a portion between the fingers, and is evident to the taste, it having rather a nutty flavour. Besides containing from 20 to 25 per cent. of a very feeding oil, we have 15 per cent. of flesh-forming material—about equal to good barley meal—only 15 per cent. of woody fibre, and a considerable amount of ash. Altogether, then, analysis indicates a most valuable substance, which, when mixed with other materials, will prove an economical food, and this view has been fully confirmed by practical experience. It has been tried for cattle, sheep, and pigs. The effect on milk is remarkable, increasing the quantity and especially the richness of the produce without affecting the flavour of the butter. The dairymen in Leicestershire have used it very largely, and found it of the greatest service during last winter to help out the natural produce. For sheep it has also been successfully used. Indeed, it is useful for any stock, whether

growing or fattening, provided we mix with it other food. The only point requiring care is in getting stock to take it. Animals that are in high condition and have been accustomed to oil cake do not take to it so readily as poor stock, but a little patience and perseverance will soon overcome this difficulty, and when once accustomed they will eat it readily. Mr. Clarke, steward to Mr. Edward Holland, M.P., tells me that his short-horn heifers, which received the best oil cake through the summer, have done quite as well upon the same weight of palm-nut meal, and when we compare the prices of the two, £6 a ton for nut meal, and £11 to £12 for linseed cake, we can understand the value of this new feeding material. Messrs. A. M. Smith and Co., of Kent-street, Liverpool, are the only English makers. Palm-nut kernel cake and meal from Hamburg is an inferior article, since the oil is extracted by a different process, dissolved out, I believe, and a smaller per-centage, about half, remains in the cake. It is a harsh, dry material, very different in appearance and taste from the English meal.

The following table shows the composition of both :—

	English Palm Nut Meal.	Hamburg Cake.	Hamburg Meal.
Moisture	7·21	12·91	10·84
Fatty matters	22·79	9·48	12·49
*Albuminous compounds	15·56	18·25	14·06
Mucilage, gum, and digestible fibre	36·24	39·16	43·56
Woody fibre (cellulose)	14·90	16·90	15·32
Mineral matters	3·30	3·30	3·73
	100·00	100·00	100·00
*Containing nitrogen	2·49	2·87	2·25

I look upon palm-nut meal as the best substitute for linseed cake that has yet been offered to the public. Its large amount of ready-made fat supplies a most valuable material, of which our home-grown foods are all deficient. Its reasonable price renders it a decidedly cheap food, that will compare favourably with grain, even at its present low price; and, from an extensive experience, I recommend it to the agricultural public as a valuable feeding material.

The question of employing Indian-corn, lentils, &c., depends upon the comparative cost of such articles and barley, beans, and peas. At present prices it hardly answers to sell our own produce and purchase such food, as the difference in price, according to quality, is not enough to cover expenses of taking to market. Indeed, during this last winter, a considerable quantity of the coarser descriptions of wheat have been ground up, mixed with some fat-producing food, and used with good results as cattle food.

Locust Beans, which contain over 50 per cent. of sugar, have been from time to time advocated, but save as an ingredient of the various cattle foods, which are extensively advertised, they have not come into general use. The importation is limited. Ground into meal, the use of from 10 to 15 per cent. is to be recommended, as it gives a relish, and makes the animals eat less palatable food. The same amount of malt would possibly do as well.

Malt.—Mr. Lawes' experiments have shown that there is no advantage in using malt in place of barley, or, indeed, in mixing the two. A considerable loss occurs in the process of malting, besides the cost of the operation. On the other hand, we know that many of our most successful feeders have been in the habit of adding a small portion of malt to their other food, when they desire to feed an animal to an extreme point; and I think it is a question that is worth careful investigation as to whether the addition of a small quantity of meal would or would not prove advantageous. Judging from the use of locust-beans, which, when given largely, destroy the animal's appetite, I should have concluded, independently of Mr. Lawes' experiments, that malt would not do if supplied in any quantity; too much sugar is objectionable.

A word as to *Cattle Condiments*.—If animals are out of health and require a tonic to stimulate digestion, then the addition to the ordinary food of some substance like fenugreek, aniseed, or caraways, in a small proportion, will be found useful, creating an appetite. If, again, we are fattening an animal to an extraordinary degree, we may use stimulants to induce an appetite, but to suppose that young healthy animals, or ordinarily fed stock, require such materials, is a mistake. By using such things we shall decidedly destroy or injure the digestive system; and to pay from £25 to £40 a ton for the so-called cattle foods is most unprofitable. I might quote the opinions of Mr. Lawes and Professor Simmonds on this point, with which I thoroughly concur. Whilst fully allowing that several of the ingredients possess medicinal properties, Professor Simmonds states that the same objects may be attained by the farmer who mixes well-ground linseed meal with pea and bean meal, adding a small quantity of salt (and, I should say, locust bean meal), with a simple stomachic, nothing being cheaper than fenugreek mixed with aniseed. Such a compound need not cost more than 15s. to 16s. per cwt. If, however, I cannot advocate the so-called cattle condiments, but, on the other hand, consider them most extravagant, and often quite unnecessary, I greatly approve the mechanical condition in which these meals are prepared, and would recommend that now grinding mills are so improved, farmers should endeavour to prepare their food more carefully, and combine together a variety of materials; this leads me to the last portion of our subject, viz.:—

The Different Methods of Feeding.

The digestive apparatus of the ox, sheep, and pig differ materially, and a study of this difference teaches us some general truths as to the description of food suitable for each. The ox possesses a larger proportion of digestive apparatus for a given live weight than any animal; the sheep comes next, the pig the least. Thus the ox, with his large and complicated stomach, and comparatively small intestines, evidently requires a bulky food, containing a considerable portion of indigestible fibre. The stomach must be filled, and therefore the food, to be of use, must be bulky. For every 100lbs. of live weight the ox has 11½lbs. of stomach, and only 2½lbs. of intestines. The sheep has much less stomach and more intestines, and altogether a smaller per centage of digestive apparatus, indicating that whilst the sheep may and should consume some portion of woody matter, its food should contain a large proportion of starch and allied digestible matter—substances that are rendered soluble by the secretions of the intestines. The pig has only 1⅓lb. of stomach and 6lbs. of intestines to each 100lbs. of live weight—showing what we know by experience to be a fact, that this animal requires a concentrated and highly nutritious food, and would starve upon what would be a generous diet for the ox. The great proportion of intestine shows the necessity of a starchy kind of food. These are important points as indicating the descriptions of food that these three classes of animals will require. Thus, for instance, bullocks have been fattened entirely on good straw and oil cakes. Such a food would not do for sheep, as they require in addition a considerable portion of vegetables rich in starch, whilst pigs flourish best when fed entirely on meal.

It might have been supposed that on a subject so important, repeated experiments would have been carried out, and a formula arrived at, so that the process of feeding young, growing, and fattening animals, whether cattle, sheep, or pigs, would be as well defined and understood as any other manufacturing business. But an

agricultural experiment, especially upon live stock, is very difficult to carry out, and we are liable to be misled by results. We find that several well worked out experiments, as those of the Duke of Bedford, Messrs. Lawes and Gilbert, &c., have been made, but the object has been rather to determine the merits of different animals than to test the kinds of food. It is, therefore, with considerable hesitation that I venture to submit for your consideration the following mixture of food as likely to prove economical.

For animals growing and fattening at the same time (this will apply to the animal when weaned till killed), the amount of such food depending upon age :—

Linseed cake, or cotton cake	2lbs.
Barley, or wheat meal, or palm-nut meal, or a mixture of all three....................	4 ,,
Beans or peas, or mixture	2 ,,
Locust beans or malt	1 ,,

In the above mixture we get a good proportion of the flesh-forming and fat-forming food. We might, in the later stages of feeding, increase the quantities of the linseed cake, and reduce or do away with the beans.

For sheep a mixture of the fat-producing food—such as linseed cake or palm-nut meal—with peas and oats crushed, in equal proportions, would make a good mixture easy to be used; whilst for pigs a mixture of barley meal, Indian corn if cheap, palm nut meal, and beans, peas, or lentils may be used. Suppose we give barley one-third, Indian corn and palm nut meal, in equal quantities, one-third, and beans, &c., one-third.

A great point in feeding is not to give a larger amount of artificial food than the animal can assimilate. Frequently we find excessive quantities of cake and corn supplied, much of which must be wasted, or, at any rate, pass through the animal. Besides this, animals so over-fed are liable to inflammatory attacks, and, moreover, cramming, especially at an early stage, destroys the digestive powers. A great distinction, then, must be drawn between the supply of generous food suitable for developing the frame and growing bone, flesh, and fat in proper proportions, and the wasteful practice of stuffing an animal under a sort of idea that there cannot be too much of a good thing. Thus calves, during their first year, will not require daily more than from 1 to 2 lbs. of the first named mixture; from the first to the second year from 2 to 3 lbs.; and to be finished up with say 4 to 5 lbs., for we ought to have our animal, which has been growing and fattening ever since it saw the light, fit for the butcher at about 2½ years old. The practice of fattening old oxen is not nearly so common as formerly, still we may now and then have an opportunity of seeing how much food such animals will consume. If we begin when the animal is poor, we must supply bulk rather than quality, as there is a large vacuum to fill up; therefore to begin fattening a large beast with 8 or 10 lbs. of oil cake a-day is a radical error. I should say 6 lbs. of the mixture I have suggested, or of equal portions of cake and meal, would be enough for the first month; each succeeding month we may increase the artificial food from 1 to 2 lbs. a day. In no instance, and under no circumstances, do I believe it is right to use more than 6 to 7 lbs. of a rich, fat-producing food, whether that food be linseed oil cake or any similar material.

In the case of sheep, we may begin artificial food as soon as the lamb can eat. At about a month old a mixture of fine dust oil cake, bran, crushed oats, and finely bruised peas, may be used with good effect. The quantity consumed at this time is very small, but the animal learns how to eat, and when thrown upon its own resources, after weaning, runs to the corn trough and feeds freely through the summer; and until the lamb goes on turnips, ¼ lb. a day of artificial food is ample, ½ lb. from this time until Christmas, then ¾lb., and possibly, during the last month or two of feeding, we may give as much as 1 lb. a head daily. Stock lambs—those intended for breeding—should be fed like the others during summer, and will generally do very well on a fair quantity of roots and dry food, without other helps, during the winter. With regard to pigs, it is more difficult to lay down any rules. The pig should have about as much as he can eat. There is one peculiarity in the habits of the pig that should be noticed—they are sure to do best on sour food; thus an old authority tells us—"The most profitable mode of converting any kind of corn into food for swine, consists in grinding it into meal, and mixing the latter with water, in cisterns, in the proportion of 5 bushels of meal to 100 gallons of water; this must be well stirred several times in the day for a fortnight, during warm weather, or for three weeks in a colder season; at the expiration of which time it will have fermented and become acid. In this state, and not before, the wash is ready for use; it ought to be stirred every time before feeding, and it will be necessary to keep two or three cisterns fermenting in succession, in order to prevent it being used before it is duly prepared. The difference of profit between feeding in this manner and giving the grain whole, or only ground," adds Mr. Young, whose words I quote, "is so great, that whoever tries it once will not be induced to change it for the common methods." I have never tried this method of feeding myself, but believe it is founded on experience and reason. The pig is the scavenger of a farm, and we know that when in a store state much of his food is in a state of fermentation. However, many may prefer a more modern system, namely, that of mixing the meal with boiling water, by which the insoluble cells that contain the gum and sugar of the grain are burst and the food is improved in quality. Cooking will answer for the pig better than for ruminants; indeed, I do not approve of cooking food for cattle or sheep. We may, in some instances, do well to prepare a soup of boiled cake, meal, &c., and pour it over dry chaff, or what is better, we may use our waste steam to pass through a mixture of chaff, pulped roots, and the artificial food we are using. Such a process must, however, be carried on every day, as beasts do not relish such food when it becomes stale. The mixture of chaff and pulped roots, in properly constructed bins, leads to a gentle fermentation, which adds to the value of the food; and such a mixture will keep good for at least 24 hours, so we may prepare one day's food in advance. This is, I believe, the best and the most economical plan that can be adopted. The quantity of roots will depend upon a variety of circumstances, which time will not allow me to discuss. To show the change in our practice, I may mention that a large bullock formerly ate 1½ to 2 cwts. of swedes per diem. Now, a better result is obtained by using three quarters of a cwt. pulped, with a mixture of hay, straw, and chaff; and, in many instances, animals are well fed upon 56 or 60 lbs. a day. Sheep still eat according to their live weight an immense weight of roots—in many instances as much as 20 lbs. a day. Now, this is not a perfect plan of feeding, and I believe the time is not far distant when a great change will take place, and sheep will be treated to pulped roots and chaff just as cattle are, only with a smaller proportion of straw and more roots. In this way an increased quantity of sheep will be kept in a healthier and, at any rate, in a more economical manner.

Gentlemen, I have done, and have only to thank you for the kind attention with which you have listened to my remarks.

DISCUSSION.

The Chairman said the paper they had just heard was remarkable for the amount of practical information it contained. Professor Coleman had scarcely given an opinion without stating the reasons on which that opinion was based, and those were founded on practical experience. He agreed thoroughly, as far as his own experience went, in a large amount of what had been stated in the paper,

but more particularly he agreed in this—that it was often the case that while a food by itself was of little value, that same food, if mixed with other ingredients, became invaluable. The great point was to get the proper proportions of nourishing and bulky matter to suit the animal they were feeding. But with cattle this was too often forgotten—that only a certain portion of nourishment could enter into the system; and, therefore, unnecessary expense was incurred by giving an excess of food. An animal with so many stomachs as a ruminating animal possessed, must, as Professor Coleman had remarked, have a large bulk of food, so as to enable the work of digestion to be performed in the ruminating system. That bulk need not of necessity be entirely of expensive food, but, at the same time, if the inexpensive food, such as chaff, were previously prepared by being made more or less succulent, it was rendered more suitable to the natural requirements of the animal. In this way he thought the application of steam for the softening of chaff, whether hay or straw, was of very great value. On his own farm the chaff was cut in a loft, whence it was discharged into a vessel of iron, about twelve feet square, and thickly perforated with small holes at the bottom. In the next building but one was a steam-engine, the waste steam from which was brought by a pipe underneath the perforated bottom of the vessel, so that there was thus sufficient heat to cook that vessel full of potatoes, if potatoes were the food employed. The steam cooked the chaff most perfectly, and when it was thus brought into a succulent state, it was then in a condition to be mixed with advantage with the more nourishing qualities of food which they chose to give the animal, and he found in that way there was great economy in feeding. It was only a few days ago he calculated the expense he was at in connection with a set of feeding boxes appropriated to fifteen head of cattle, when he found that at a cost of 11s. per head per week, they made on an average three pounds weight each per day, and it was only matter of further calculation to ascertain whether that was profitable feeding. He believed Professor Coleman to be correct in almost every respect, but more particularly he thought he was right in his remarks upon sheep feeding, and that it was useless to try to feed sheep with the same description of food as was suitable for the ox or the cow. He had fallen into that mistake himself, inasmuch as in hard winters he had attempted to make large quantities of artificial food, and he found, when chaff formed a large ingredient of that food for sheep as well as oxen, invariably the chaff was not eaten by the sheep, showing that it was not a suitable food for those animals. The late severe winter had been a very trying one in respect of feeding cattle. He (the chairman) lived in a cider country, and it occurred to him that the large quantities of apple pulp which were produced might be made available as an ingredient of food for his cattle. On mixing this with chaff and meal, to his great delight he found the cattle exhibited a great relish for it, which led him to manufacture cider to a very large extent, merely for the sake of the pulp with which to feed the cattle, and the result proved not only beneficial to the animals, but very economical. He had been told by his friend, Dr. Voelcker, that in Germany apples were largely used in feeding cows, and if that were the case, it confirmed the results of his own experience. In conclusion he would say, as far as he understood the subject, the paper with which they had been favoured was eminently a practical one, and could not fail to be serviceable to all who read it.

Mr. G. F. Wilson, F.R.S., said there was one kind of food on which Professor Coleman had laid considerable stress, viz., the palm-nut kernel. Having had much to do with palm nuts, he might state that the supply of them in Africa was enormous; and inasmuch as the value of the oil expressed from those nuts in this country was so much higher than that of the dull-brown, burnt oil as expressed in Africa, he thought, with the price obtained for the cake, it must be a good paying process. He recollected some years ago, when pleuro-pneumonia was prevalent amongst cattle, Mr. Horsfall, of Ottley, used cocoa nut oil as a remedy, with very successful results. Now the oil of the palm nut happened to be identical with that of the larger palm nut, the cocoa-nut; and it might be a question with agriculturists whether an oil similar to that which was found useful as a remedy in the case mentioned, might not also serve as a preventive of disease.

Dr. Voelcker was glad to find that Professor Coleman had laid stress upon the condition of the food when given to the animal, as this was a matter too frequently neglected by those who gave opinions on the qualities of foods. They were too much in the habit of comparing merely the composition of one food with that of another, from which different conclusions were often arrived at as to the practical effect they were likely to produce when given to cattle. He thought this was a great mistake, for they knew by experience, that at one time the mangold was more nutritious than the turnip, and at another time it was the reverse. It was in this case entirely a question of maturity, for the same amount of woody fibre in a properly matured root was very nutritious, whilst in the unripe state of the root it was not so, and in the over-ripe state it was absolutely injurious; therefore the condition of the food materially influenced its nutritive value. Then there was another condition of food, viz., that which arose from keeping it in damp, unventilated places. He more particularly alluded to corn and concentrated food, such as oil cake, peas, beans, and lentils. Food, under such circumstances, was apt to become mouldy, and the microscope revealed the presence of certain lower vegetable organisms or fungi, some of which were decidedly poisonous to animals. He knew of many cases of such poisoning, which were clearly attributable to the fungi attached to food in the condition he had referred to. Professor Varnell, whom he was happy to see present, had informed him of a case of poisoning arising probably from musty food, and that gentleman would probably favour them with his experience. Whilst laying full stress upon the importance of this point, he could not agree with his friend Professor Coleman when he said that the absence of any analytical tests was one of the greatest impediments in securing pure linseed cake. They could examine, analytically, many kinds of cake for the presence of certain injurious materials. Rape cake admitted of an easy test. The presence of mustard was rapidly traceable by the formation of a pungent essential oil, when the crushed cake was mixed with lukewarm water, and allowed to stand for several hours. In addition to many other tests they had the microscope, which, in conjunction with the natural senses of taste and smell, was as good an analytical test as they could desire in such matters. One point in which he did not agree with Professor Coleman was in the statement that there was difficulty in procuring pure and clean linseed cake. There was a wholesome regulation in the seed-crushing trade of paying a price for the seed in proportion to its freedom from foreign substances. Beyond 5 per cent., which was the standard of foreign matter, an allowance in price must be made proportional to the amount of adulteration. There was no doubt, by paying a proper price, pure linseed could be obtained, and, therefore, pure cake; and he believed there was no indisposition on the part of the crushers to manufacture pure cake if they were paid a fair price for it. At the same time, he was aware that a great deal of oil-cake was sent into the market with the mark "P"—pure—upon it which was very largely adulterated by foreign matters. If farmers would have their cake tested under the microscope, which they could do at little expense, they might always secure good cake; and if there was a demand for that quality of food he had no doubt it would be supplied. With these trifling points of difference only, he entirely concurred in all that had been stated by Professor Coleman.

After a few remarks from Mr. Varley,

Dr. Crace Calvert, F.R.S., said he had listened to the paper of Professor Coleman with the greatest pleasure; the more so as it had reference to a subject which, up to the present time, he believed, had received the attention of very few scientific men. If there was any knowledge on the subject amongst farmers, most of them had kept it to themselves, and he believed the public in general were not acquainted with the facts brought before them in this able paper. He had read a great number of papers from time to time respecting the feeding of cattle, and he had always been struck with the want of practical knowledge shown by those engaged in such researches, for those who had devoted any attention to this subject were, generally speaking, purely scientific men. There were on the Continent several eminent chemists who had given a great deal of attention to this subject, and at some future period he (Dr. Calvert) might have occasion to refer to some of their researches, and he would then be able, in a more forcible manner, to prove the truth of his assertion; but his point now was to show, in as marked a manner as possible, the want of practical information which Professor Coleman's paper had gone so far to supply. Thus it was found that Mr. Boussingault, one of the leading scientific chemists of Europe, attempted to feed some cows on carrots, as he thought it admirable food for them, but they decreased in weight and lost flesh. Why was this? Professor Coleman had given the explanation, that it was necessary that there should be bulk in the food as well as nutriment, and the great point was to give both in proper proportions. The Chairman had mentioned that in his own case he gave his sheep too much chaff in that instance; the bulk was too great as compared with the nutritive matter contained in the chaff. There was one very interesting point which Mr. Coleman had referred to, namely, that it was not sufficient merely to give an animal a large amount of nitrogenated food, but in order to get the full effect from such food, it was found necessary that it should be mixed with a relative proportion of saccharine, amylaceous, or other heat-giving food. This confirmed the impression that he (Dr. Calvert) had had for many years, that such ratios between the various classes of food must be carefully preserved. He had been led to this view by the researches of one of the most intelligent chemists on the continent, M. Ville, who investigated the application of ammoniacal salts and other nitrogenated manures to the growth of plants, and made this interesting observation, that if to plants a certain quantity of ammoniacal salts or nitrate of soda were supplied, only a limited amount of nitrogen was absorbed, but if to these nitrogenated substances phosphate of lime was added, the result was most favourable, the plants absorbing eight or ten times as much nitrogen in the same period of time; the absorption of the nitrogen being nearly in a direct ratio to the proportion of phosphate of lime added. With respect to the feeding of cattle, he was struck by the remark of Professor Coleman, that if they gave to cattle too much of one class of food, either of fat-forming or respiratory food, there was a loss. It therefore occurred to his mind that both for men and cattle (for what held good in the one case held good also in the other) there must be a definite ratio of food which time and science would reveal. He was satisfied, from his own experience, that the paper read this evening was one most valuable to the farmers of this country, because the science of the subject was mixed up with sound practical knowledge, and that was the class of information which the farmers most required.

Prof. Varnell said reference having been made to his name in connection with the poisoning of cattle from the presence of injurious substances in the food, he would briefly state the circumstances of the case. He would in the first place endorse the opinion expressed by Dr. Voelcker, as to the importance of the microscope in these investigations, and every feeder of cattle ought to be possessed of that instrument and know how to use it properly. Two or three years ago he was professionally applied to on the occasion of the death of some valuable cows in an apparently mysterious manner. He found the cause of death to be spleenic apoplexy. At first he gave an opinion that perhaps some fungi attaching to the food had been taken into the system, and on investigation he found that the cattle afflicted had been grazing on ergotised rye-grass. He was very glad Professor Coleman had laid so much stress upon diseases arising from indigestible food. He had met with many instances of deaths of animals from eating decorticated cake, and in some cases from feeding largely on bean straw, the straw not having been cut in the green state, but allowed to become over-ripened on the ground where it was grown. With reference to the circumstance alluded to by Dr. Voelcker, of fungi forming upon oats stored in damp places, he would mention a fact of importance to feeders of cattle. He was applied to from Leeds respecting the death of half-a-dozen horses, which occurred in about three days, and the cause of which it was difficult to trace. A quantity of the oats on which they had been fed was sent to him for examination, and he found that many of the grains were matted together by a flocky substance. Microscopical investigation showed the presence of distinct fungi as completely developed as mushrooms, though very minute. The flocky material proved to be jointed filaments, and the effects of eating that substance had been to produce the death of the horses. He tried the effects of the oats which had been sent to him upon other valueless horses, which died thirty-six hours after eating them, with the same symptoms exhibited. On an examination of the smaller intestines of the animals he found that the mucous membrane was thickened by a peculiar growth on the surface.

On the motion of the Chairman, a vote of thanks was passed to Professor Coleman for his paper.

Professor Coleman thanked the meeting for the attention with which they had listened to his paper, and he was glad it had led to some practical remarks in the discussion. With reference to the observations of Dr. Voelcker, as to the absence of analytical tests of food for cattle, he did not state that such tests did not exist, but that they were very seldom employed by farmers. He thought the want of appreciation of these tests was a great error on the part of consumers, and he certainly strongly advised the use of the microscope in such matters.

SOUTH LONDON WORKING CLASSES INDUSTRIAL EXHIBITION.

The prizes awarded to the exhibitors at this exhibition were presented on Saturday, the 1st instant, by the Right Hon. Viscount Palmerston, K.G.

The noble lord was accompanied by the Earl of Shaftesbury, the Right Hon. W. Cowper, Mr. Locke, M.P., Mr. Charles Gilpin, M.P., and many others.

Mr. Murphy, the honorary secretary, then read the report of the adjudicators, which stated that they deemed it desirable that, whatever the profits of the undertaking, they should be distributed among as many exhibitors as possible, rather than be expended in giving large sums to a few; this would account for the great number of prizes awarded and honourable mentions made. It was also deemed advisable that the awards should be of equal value in the different classes, and that a medal should be struck to commemorate the holding of the exhibition, a copy of which (in either silver or bronze) the holders of the superior prizes might take as a portion of the value awarded. The accounts had not yet been audited, but the distribution assumed a profit of £300. The first-class prize was £3, the second £1 10s., the third-class prizeholders would receive a bronze medal in case; and a highly ornamented card was prepared for those who had received honourable mention. Whatever sum of money might remain over when a settlement was made would be distributed in fair proportions, as per the vote of the committee. The

following is a summary of the awards :—First class, 35; second, 85; third, 123; honourable mention, 129; total, 372. It may be interesting to state, that out of 120 first and second class prizeholders, 110 have chosen that a portion of their prize should consist of a medal as per the prize design. Of these 77 have chosen silver, and 33 bronze mementoes of the Exhibition.

Lord Palmerston distributed the prizes, and then delivered an encouraging address, pointing out the favourable influences of such exhibitions. The Rev. Mr. Bowstead moved, and the Rev. Newman Hall seconded, a vote of thanks to Lord Palmerston.

DUBLIN INTERNATIONAL EXHIBITION.

The fine art collection from Rome will be very rich. A steamer, freighted with more than 100 works in sculpture and other articles, was to leave Civita Vecchia direct for Kingstown on the 1st of April. Among the artists who contribute works are the following:—G. B. Lombardi, 7 works; Benzoni, 16; Jacometti, 5; Adams, Carlo Voos, Bisetti, Rinaldi, Kowalsky, and others, 4 each; G. Lombardi, Barrotta, L. Bienaimé, Andrei, and Miss Foley, 3 each; Miss Stebbins, Muller, Forzani, Setaccioli, Luccardi, Provinciali, Galletti, Ferraria, and Larchetti, 2 each; Hogan, Achterman, A. Bienaimé, Story, Baroni, Bizzi, Majoli, Moratilla, Rossetti, Valli, Prior, Di Giacomo, Salvatore, Obici, Hoffman, Schoops, Freund, Palombi, Giacomini, and Daly, 1 each. Mr. Randolph Rogers, the American sculptor, has consented to send a half-size figure of his well-known statue of "Nydia fleeing from Pompeii," from Bulwer's novel. Miss Hosmer has a group, and there is a colossal statue of Pius IX. in marble. There are also others, not specified.

Among the painters are Romako, de Rossi, Vertunni, Wider, Guerra, Bompiami, Muller, Bertacini, Brenan, Skirmunt, Farrel, Porcelli, Podesti, Strutt, A. Dies, Raggio, Rohden, Bartolomei, &c. Saulini sends twenty of his own cameos in shell and pietra dura.

Pieret sends a collection of very rare and valuable intaglios and cameos in pietra dura. Monsignor Ferrari (Minister of Finance) sends three portfolios and three volumes of engravings. Olivieri, specimens of bookbinding. Cardinal Prince Altieri sends, by the arrangement of Professor Ponzi, an interesting collection of minerals and maps of the Alumiere and Tolfa; Castrali, wax candles; Tucri, olive-oil; the Countess Mami sends sulphur products from Canale; Pozzi, artificial pearls; Dies, Rimaldi and Barberi send mosaics, the latter 41 specimens. The Pope also sends mosaics from his own works in the Vatican and specimens of his chromo-lithography. The Minister of Public Works sends specimens of the works of Vizia in cloth of silk and gold, as also specimens of Roman carpets; Martinori, two discs of Egyptian alabaster. Nazzari sends liqueurs, chocolate, and sweetmeats. Toni, the gun-maker, some guns. Vespignani, frame-work in ivory and gold; and Cavaliere De Rossi sends a most interesting plan of the Catacombs.

The colonies will be admirably represented as far as the restricted space allotted to them will allow.

From Natal, principally through the active instrumentality of Mr. John Robinson, a very fine collection has already arrived by the steamer Eastern Province, and a further consignment will come by the next mail steamer. Among the Natal collection are some most interesting curiosities and native manufactures, from Central Africa, collected by Mr. Barry and Mr. Baldwin, during their recent travels. The first-named gentleman has done what no European has done before, namely, crossed the continent from Walvisch Bay to Natal. He has been just a year on the way. The indigenous timber resources will be well represented in about forty varieties of colonial woods, contributed by Dr. Mann and Messrs. Topham, Brothers. Among the Bechuana articles worth notice are the poisoned arrows, the poison being obtained from a small beetle; a large native pot, of superior workmanship to anything known in South Africa; ropes, twine, and fibres from the vicinity of the Great Lake; a sheathed war-knife from a tribe never visited by white men, living in that unexplored coast district on the south of the Zambezi. The raw materials of the colony, cotton, wool, sugar, colonial spirits, coffee, maize, tobacco and cigars, preserved fruit, &c., are well represented. The collection also includes photographs, Zulu curiosities, including a most elaborate piece of Zulu wood carving, which took three years to complete. There are also karosses, or cloaks, of jackal and other skins; two splendid lion skins, one a thick-maned specimen; some magnificent bows, and other native weapons. The African Aid Society, the Church Missionary Society, the Liberian Consul-General, and others contribute African products.

Malta will make a fine display of laces and silver filigree.

OPERATIVE COACHMAKERS' EXHIBITION.

The prizes awarded at this exhibition by the judges—the Marquis of Lansdowne, Viscount Torrington, R. C. Mansell, Esq., Mr. Hall, of Long-acre; Mr. Holdway, of Mount-street; and Mr. Rock, of Hastings—were distributed on Monday evening last, by the Right Hon. Lord Truro, in the great room of the Society of Arts. On his lordship taking the chair,

Mr. G. N. Hooper, chairman of the committee, read an address expressing their satisfaction at the success of the exhibition, which had exceeded their most sanguine expectations. They had received the most cordial assistance from all parties, and hoped that this success would open a new era to employers and operatives of the coachmaking trade, who would now, they hoped, maintain their place against the competition of foreign countries. They had enjoyed the advantage of a thoroughly independent committee of judges, and it had been considered advisable to distribute the awards liberally where merit existed, notwithstanding the absence of competition in many cases. They hoped that this liberality would act as a stimulus for the future, and that a keener competition would be the result in the next exhibition. The address concluded as follows:—"Meeting as we do in the house of the Society for the Encouragement of Arts, Manufactures, and Commerce, we are reminded that a work small at its commencement may grow in the course of years to national importance. We cannot look forward to benefit the nation so extensively as this great and noble Society, but at a humble distance we have endeavoured to follow their example, and originate what we hope may confer great benefit on the carriage operatives, and indirectly the whole nation to which they belong. All honour to the Society of Arts, which by its example and enterprise has endeavoured to elevate the character of working men; among its efforts the encouragement of Working Men's Exhibitions will doubtless effect much good, and facilitate many other good plans for helping them to help themselves, rather than allowing them to rely blindly on employers and the government in matters where personal character that is self-reliant can effect more than any external help whatever."

Lord Truro then presented the prizes as follows:—

The Society of Arts prize for the best specimen of chasing, to J. Corbett; the Coachmakers' Company's bronze medals, to F. Humphreys, John Adcock, H. Pilbeam, and J. Bassett; the Master of the Coachmakers' Company (Thos. How, Esq.), for the best design of an open and close carriage combined, to W. T. Allam; Mr. G. N. Hooper's prize of three guineas for a drawing of a barouche, W. C. Bolt, and of two guineas for a drawing of an hospital carriage, James Robinson; Mr. G. A. Thrupp's prizes of two guineas for the best stuffed cushion

in morocco, Henry Headford, and for the best drawing of an under-carriage, Henry Semon; Messrs. Woodall's prizes of two guineas for the best panel of carriage painting, John M. Dean, and for the best finished pad and bridle, Edward Spendlove; and of one guinea for the best hand-sawn dash iron, Wm. Wood; Mr. Barlow's prize of two guineas for the best set of harness furniture, new design, to H. Birch; of half-a-guinea for the best working drawings of bridle fronts, R. Burgess; for the best specimens of hard-solder plating and soft-solder plating, D. Jones and W. Sheldon. The committee's prizes—of two guineas, for the best specimen of heraldic painting, to J. J. Cowens; for the best specimen of decorative coach carving, J. Wyatt; for the best set of working drawings for an improved brougham carriage, A. Brewer; for the best specimen of sham caning, C. H. Fuller; for the best seat, the border sewn by hand, T. Robinson; for the best method of detaching fallen horses, J. Hammerton; for the best cushion, stuffed and quilted, A. Townsend.

Certificates of merit were next presented:—

For drawings of carriages to Joseph Butler; model of a landau, J. J. Norcott; drawing of improved hinge, Charles Toogood; model of improved hinge, a photograph and rule, John Weekes; apparatus for drawing C springs, Alfred Brewer; machine for drawing off fast-set axles boxes, J. Smith; painted spokes, sham caning and striping, W. Hewitt, jun.; a plain varnished panel, J. Gibbs, imitation basket-work, &c., W. Ninham; six spokes painted, W. Simpson; panels of various colours, Henry Smee; a spring cushion, Carl Moller; a carriage seat, caned beneath and improved cushion, William Stephens; a model of a hammercloth, William Woolford; an improved awl, saving prick marking, Henry Wyatt; specimens of soft silver plating, George Coster, a case of lamps, the workmen at Mrs. Salsbury's; a panel of monograms, F. V. Hadlow; chased door handle and harness ornaments, Joseph Little; drawings, of drag, barouche, &c., S. H. Birch; coloured drawing of dress coach, J. Hewitt, jun.; various drawings of carriages, P. Roduwart; models of railway carriages, Wm. Hacker; brass model of carriage with portable railway, James Henwood; model of a state hammercloth, a straining joint, W. J. Murlis; a self-acting step to fold up under when carriage door shuts, H. S. Dobson; model of a brougham, J. T. Brown; new and inexpensive Venetian blind, J. J. Tattam; drawing of state harness, C. Muckersie; driving cushions of new designs, J. W. Berriff.

The prizes having been distributed, the Chairman said he regretted the absence of the Marquis of Lansdowne, who was much more intimately acquainted with the subject than himself. He hoped some of those who had been unsuccessful would not feel discouraged, for many of the articles now not successful might contain the germs of inventions likely to be valuable in future. The coachmaking trade required as much skill and ingenuity as any branch of industry. He observed with pleasure that the largest number of prizes had been given for what argued a high standard of education in the recipients. Twenty-one prizes for artistic merit had been awarded, thirteen for mechanical contrivances, and seventeen for manual skill.

A vote of thanks to the Chairman concluded the proceedings.

PARIS UNIVERSAL EXHIBITION, 1867.

The following is a translation of the official announcements published in the *Moniteur* of the 21st Feb., 1865:—

Report to the Emperor.

Sire.—In conformity with your Majesty's order, I have had the honour to inform his Imperial Highness Prince Napoleon that the time has arrived for him to become the president of a commission which will be formed for the purpose of carrying out the decree of the 22nd June, 1863, for the holding of a universal exhibition in 1867. I have prayed his Imperial Highness to be good enough to communicate to me the general views on such an undertaking, suggested by the experience gained by him in 1855 and 1862, and then to call a meeting of competent men to discuss the preliminaries of such a subject. I now submit to your Majesty the conclusions drawn from these preliminary measures. The next important point being a good financial organisation, I have referred to the results drawn from the two exhibitions in London and the one in Paris.

In London, in 1851, as well as in 1862, the initiative was taken by a number of persons who raised a guarantee fund, upon the faith of which the Bank of England supplied all the necessary funds at a moderate rate of interest. The commission for 1851 built a temporary structure, with a boarded area of 71,000 square metres (ground-floor and galleries); the receipts amounted to 12,700,000 francs, and, after defraying all expenses, a surplus of 5,300,000 francs remained. The commission of 1862 raised a building of 120,000 square metres in area, a part of which was designed to be permanent. The total receipts, with a grant of 250,000 francs from the contractor, just sufficed to cover the whole expenditure of 11,500,000 francs. At Paris, in 1855, the State, in undertaking the enterprise, was obliged to erect temporary buildings of 68,000 square metres, in order to supplement the area of 47,000 square metres provided by the permanent building erected by a company. The receipts amounted to 3,200,000 francs, and there was a total loss of 8,100,000 francs. It was ultimately determined to expend a sum of 11,000,000 francs for the re-purchase of the palace. The total expense, amounting to 21,000,000 francs, is covered partly by the possession of the Palais de l'Industrie.

In the face of these facts the question arises whether the system of commissions, such as conducted the two exhibitions in England, the one at a gain, and the other without loss, should be adopted; but, influenced by the subjoined conclusions, I am induced to give a negative reply.

In England the public willingly pays high charges to procure for itself the means of instruction, or to visit Institutions devoted to science and art. Thus, in London, in 1862, a sum of 10,200,000 francs was received from 6,000,000 visitors, raised—first, by the minimum entrance fee of one shilling (1f. 25c.), and secondly, by season tickets and entrance fees varying from 2s. 6d. to £1 (3fr. 10c. to 25 francs). In France, until recently, the public were but little inclined to pay or bear such charges. Thus, in Paris, in 1855, 4,600,000 visitors only paid a sum of 3,200,000 francs; the entrance fees, at 20 centimes and at 1 franc, produced 2,600,000 francs, whilst those at 2 and 5 francs, with the sale of season tickets, produced but 600,000 francs. Assuredly better results may be expected in 1867; peace will be more fruitful than the war which was raging in 1855; the errors incident to a defective tariff will be avoided; finally, the public favour may be better relied on, if a competent commission punctually inaugurates the exhibition of 1867 on the day fixed for the ceremony, if it solves the problem of classification of the products of art and industry in a useful and attractive order, and if, above all, the productions of all the countries in the world are represented more completely than has been the case in previous exhibitions. Still it seems prudent to expect that, even under these conditions, the receipts at Paris in 1867 will not be so great as those in England in 1851 and 1862.

The financial success of 1851 was caused by circumstances which evidently will not occur again. The demands of the exhibitors for space were then satisfied by a building of 71,000 metres; but in 1862 even an area of 120,000 square metres was so much too small that the French exhibitors received hardly half the amount of space they applied for. The requirements of exhibitors of all nations had thus augmented, whilst public curiosity

remained stationary. These two tendencies foreshadow considerable deficit in all future exhibitions; and it appears that the way to lessen this deficit in 1867 will be, especially, to develope those branches of the exhibition which will augment the receipts in a larger proportion than the expenses. To attain this end it seems likely that a space of 140,000 square metres will be necessary. At London the chief sources of receipt, viz., the entrance fees, were increased by certain percentages taken by the commission on the profits of the contractors for the refreshment rooms, the catalogues, and on seven other sources of smaller importance. In 1862, for instance, these accessory receipts amounted to 1,000,000 francs. I do not think that in 1867, any more than in 1855, it would be well to have recourse to these financial means, which are hardly in accordance with our ideas. By organising monopolies the public is badly served, and thereby become discontented: no good is thus done to the chief source of receipts. These sorts of tax weigh, moreover, partly upon the exhibitors or their habitual representatives; and it seems injudicious to cast a burden upon so many people whom it is desirable to attract to these competitions, and who, often through a pure spirit of patriotism, are willing to bear the considerable expenses which arise from them.

In London, at the two preceding exhibitions, rewards of no intrinsic value were given to exhibitors. In France, since the Farnese Exhibition, in addition to the bronze medals, silver or gold medals have been given. I think it will be well to continue this custom, and even that it will be desirable to augment the sum devoted to prizes given in other forms.

In founding my opinion upon these considerations, I can foresee that the Exhibition of 1867 may, perhaps, require an expenditure of 18,000,000fr. I may add that the unfavourable contingencies which may happen to these kinds of enterprises do not seem likely to raise the expenditure above 20,000,000fr.; as for the receipts, they may probably amount to 7,000,000fr. or 9,000,000fr. I therefore come to the conclusion that the undertaking may cause a deficit of 12,000,000 fr. These estimates cannot vary much, whether they be applied to an entirely private undertaking, or to an exhibition carried out under the control and direction of the Government. No company having only a speculation as the object in view would propose to undertake the Universal Exhibition of 1867, unless guaranteed against inevitable losses by a subsidy, direct or indirect, at least equal to the anticipated deficit. Thus, from the financial point of view, the State would gain nothing by giving up all control over the preparation and conduct of the enterprise. Perhaps it might be said that the public interest which is the motive that induces the Treasury to participate in the expenses of this undertaking, does not permit the Government to hold itself aloof, and, moreover, it may be doubtful whether this independence would add to the *éclat*, utility, and to the success of the scheme. On the other hand, it may be admitted, without exaggeration, that in following the system of administration adopted by France in 1862, that is to say, in maintaining firmly unity of action, and strict superintendence, it may be, on this occasion, again possible to make some important reductions in the estimates. The utility of exhibitions has been clearly demonstrated by the considerations stated in the report which my predecessor had the honour to submit to your Majesty, and upon which the decree of the 22nd of June, 1863, was founded. Upon referring to these considerations I find that the State and the City of Paris have a sufficient interest in the realization of your Majesty's idea, to justify their participation in such an expenditure, by means of a subsidy. This subsidy, limited to 12,000,000 francs, might be divided in equal portions between the Treasury and the City, which, by means of this grant, would be released from all responsibility if the undertaking entailed any unlooked for expenses. The Prefect of the Seine, with whom I have consulted on this point, does not hesitate to think that the municipal council of Paris, which is always well disposed towards anything useful or generous, would not decline this participation. As for the balance estimated at 6,000,000 or 8,000,000 francs, it would be covered by the fees taken for entrance, and in case of their insufficiency, by the guarantee fund of a society formed for this purpose, under the auspices of the imperial commission. In the event of the total receipts, compared with the excess of expenditure above the 12,000,000 francs of subsidy given by the State and by the city of Paris, leaving a surplus due to the favour of the public, and the good management of the undertaking, it would be distributed in equal parts between the State, the city of Paris, and the guarantee society. By this means, Sire, industry and commerce, which are called to contribute to the *éclat* of this undertaking, and to gather advantages from it, will find themselves at the same time both taking part and interest, in the only way which the customs of our country permit, in its organisation and in the chances, either adverse or successful, which it may offer in a financial point of view. This would be at the same time a first step made in the direction of the initiative undertaken by our neighbours with so much firmness and success, and a homage rendered to the spirit of association. The natural consequence of this organisation would be to give to the guarantee society, in the working and superintendence of the enterprise, a part proportionate to its interest in it. The imperial commission might be, then, composed (in addition to its president and the ministers whose functions would qualify them for a seat at the board) of forty-one persons, chosen by the Emperor, from the competent and known persons of the State and the city of Paris, and of nineteen persons to be elected from among the guarantee society in the most practicable manner. The chances of success for future exhibitions would be increased by associating each time with the directing power persons possessing the experience of other exhibitions held previously in other countries. England being the only foreign nation which has up to the present time undertaken these kind of enterprises, I propose to your Majesty to include the names of three Englishmen in the imperial commission.

If your Majesty approve the conclusions of this report, I pray that the annexed decree may be signed.

I am, &c., &c., ARMAND BEHIC,
Minister of Agriculture, Commerce, and Public Works."

NAPOLEON,

By the Grace of God, &c.

Upon the proposition of our Minister of Agriculture, Commerce and Public Works.

Considering our decree, dated June 22, 1863, ordering an Universal Exhibition of Agricultural Products and Industry to be held in Paris, and opened on May 1, 1867;

Considering our decree, dated the same day, ordering a Universal Exhibition of Fine Arts to be opened on May 1, 1867, at the same time as the Universal Exhibition of Agricultural Products and Industry,

Have decreed and decree as follows:—

Art. 1st. The Universal Exhibition of Agricultural Products, of Industry, and Fine Arts, is placed under the direction and superintendence of a Commission, to be presided over by our well-beloved cousin, Prince Napoleon.

Art. 2nd. The following are nominated members of the Commission:—

His Excellency the Minister of State; His Excellency the Minister of Agriculture, Commerce, and Public Works; His Excellency the Minister of our Household and Fine Arts; Messrs. Barbier, Member of the Council of State, Director-General of Customs, etc.; His Excellency M. Baroche, Minister of Justice, etc.; Messrs. Elie de Beaumont, Senator, Member of the Institute, Boittelle, Préfet of Police; Michel Chevalier, Senator, Member of the Institute; R. Cobden, M.P. of England;

Lord Cowley, H.B.M. Ambassador at Paris; Deniere, late President of the Tribunal of Commerce, etc.; Denion du Pin, Administrator of the Messageries Impériales; Devinck, late President of the Tribunal of Commerce, etc.; Jean Dolfus, Manufacturer; Arlès Dufour, Member of the Chamber of Commerce of Lyons; Dumas, Senator, etc.; Dupuy de Lôme, Member of the Council of State, etc.; Favé, Colonel of Artillery, etc.; Fleury, Director-General of the Breeding Studs; His Excellency M. Fould, Financial Minister; Frémy, Governor of the Credit Foncier; Garnier, Metal Merchant, etc.; Gervais de Caen, Director of the School of Commerce; Gouin, Member of the Chamber of Commerce, etc.; Lord Granville, the Lord President of the Privy Council of England; Baron Haussmann, Senator, Préfet of the Seine; Herbet, Member of the Council of State, etc.; Ingres, Member of the Institute; La Roncière le Noury, Rear-Admiral, etc.; Marquis de Lavalette, Senator; Leboudy, Member of the Municipality of Paris; Lefuel, Member of the Institute; Le Play, Member of the Council of State; His Excellency the Duke de Morny, President of the Corps Législatif; His Excellency M. Mague, Member of the Privy Council; Onfroy, late Manufacturer, etc.; Ozenne, Member of the Council of State; the President of the Chamber of Commerce of Paris; The President of the Tribunal of Commerce of Paris; Schneider, Vice-President of the Corps Legislatif; Thouvenel, Senator.

The Commission will be ultimately increased to sixty members, exclusive of the President, the Minister of State, the Minister of Agriculture, of Commerce, and Public Works, and the Minister of our Household and Fine Arts.

Art. 3. In the case of the absence of H.I.H. the Prince Napoleon, the commission will be presided over by the Minister of State, or by one of the two Ministers of Agriculture, of Commerce, and Public Works, and of our Household and Fine Arts.

Art. 4. M. de Play is appointed General Commissioner.

Art. 5. M. de Chancourtois, Chief Engineer of Mines, is appointed Secretary.

Art. 6. Our Minister of State, our Minister of Agriculture, of Commerce, and Public Works, and the Minister of our Household and Fine Arts, are charged, each one as it concerns him, with the execution of the present decree. Done at the Tuileries, Feb. 1, 1865.

Napoleon.

Minister of Agriculture, Commerce, and Public Works,
Armand Behic.

Fine Arts.

Pompeian Curiosities.—The activity of the new Italian Government has produced, from beneath the scoria from Vesuvius that nearly two thousand years ago entombed the town of Pompeii, such an immense number of objects of utility, luxury, and curiosity, that the Museum of Naples is full to overflowing, and the authorities are puzzled how to turn these interesting relics of Roman civilization to the best account. Galleries, lofts, and cellars are crammed with objects from Pompeii, which continue to pour in from the excavations now being carried on with more ardour than ever. When Pompeii has been exhausted there will remain Herculaneum and other places over which the volcanic shroud has scarcely yet been disturbed; in short, the whole of the buried utensils and works of art, which time has not yet destroyed, of several large and populous towns. It is evident that no one museum or series of museums can conveniently receive and exhibit such a mass of antiquities, and all kinds of propositions have been made to meet the difficulties of the case. One scheme is to replace the various objects in the houses from which they came, and thus make a magnificent museum *in situ*, a taking proposal, but which is rendered impossible from the immense cost of protecting the objects from further decay and ensuring their security. Another plan is to add a disused convent to the *Museo Borbonico*, but this would be only putting off the matter and making the collection more unmanageable, less capable of arrangement than at present. In fact, the greater portion of the objects collected are almost repetitions of each other, and the museum would be infinitely more useful to the archæologist and artist if it contained only the best examples in each class, or, at any rate, just sufficient to illustrate every point, and thus bring all into view; and it appears now to be the prevailing opinion that the best method as regards the museum in question will be to preserve in it only unique and choice specimens. The next question is—What is to be done with the enormous remainder? And it is said that the government has determined on the enlightened and liberal course of distributing its superfluity amongst not only the other museums of Italy, which require completion, but also those of other countries. If such a plan should be carried out, the Italian government will earn the admiration and gratitude of every scholar and man of taste, and there is little doubt that such a generous act would not be without its advantages, and Italy might in return receive valuable articles in exchange from other countries. Such an interchange of the products of man's ingenuity would fill a worthy page in the future history of the nineteenth century.

Manufactures.

Sugar Manufacture.—Messrs. Travers and Son, in their circular, speaking of the question of the sugar duties, say:—"Sugar, as presented to us by nature, is a colourless substance—a little troubled with saline matter, and largely diluted with water, but quite guiltless of treacle, glucose, or dirt. The juice of the sugar-cane contains about 80 per cent. of water, less than 1 per cent. of saline matter, and rather more than 18 per cent. of saccharine. The saline matter is easily got rid of, and if the water were evaporated at a low temperature, the residue would be colourless sugar, as nature intended. Let us now see how man has treated this excellent gift. The primitive mode of preparing sugar was (we may safely say is, in many instances) to boil the liquor in open pans till the bulk of the water had evaporated, and the syrup had thickened. This syrup was then poured into porous vessels or baskets partially filled with clay, through which a large percentage of a dark-coloured viscous substance called treacle percolated, and the remainder, now styled raw sugar, was fit for market. Now, in this word *raw* there lurks a fallacy. It is correctly enough applied to silk or cotton in their unmanufactured state, but raw sugar is already a manufactured article; and, what is more, the term implies that such sugar is the necessary product of a primary process, and that a second process is requisite in order to convert the raw sugar into refined. Thousands of persons, no doubt, think so at the present moment. They regard brown sugar as a natural product—white sugar as a manufactured product. The idea is totally without foundation. In reality, the second process only undoes the mischief which has been accomplished by the first. Everybody knows that a piece of bread held in front of a brisk fire speedily becomes brown. This is because the sugary constituent in the flour is charred by the heat. And, in like manner, sugar-syrup, when boiled in an open pan at a temperature varying, according to the density of the syrup, from 220 to 250 degrees, becomes burnt or carbonised. Each delicate little white crystal puts on a brown coat, while the greater part of the molasses is produced through the same cause, being, in fact, nothing more than crystallisable sugar converted by excessive heat into uncrystallisable treacle. We can understand this rude

and ignorant mode of manufacture existing in former times, when the material arts were very slightly developed, and when sugar in the crudest state was hailed as an acquisition; but how comes it that at the present time, although we in Europe have invented vacuum pans, centrifugal machines, charcoal vats, and all sorts of appliances for turning brown sugar into white, that the bulk of our sugar is still shipped from the place of growth in what we may justly style an artificially-injured state? Is it that the colonial and foreign growers are too lazy and apathetic to make it any better? They are scarcely likely to be less enterprising now than they were two centuries ago and we find that in the year 1680 the West India Islands possessed several establishments for producing white sugar. But two years later the French Government imposed an extra duty on the importation of these white sugars, and in 1684 it forbade the erection of any new colonial refineries. Two reasons were assigned for this narrow policy:—the first, that as sugar had become a valuable source of taxation, a less weight, paying consequently a less tax, would be imported if sugar were refined abroad, and freed from molasses and impurities before shipment; the second, because, in accordance with the false political economy sf those times, it was considered necessary to bolster up the European refiner, and protect him from the competition of his colonial rivals. We now begin to see how it is that a clumsy and wasteful process of manufacture, begun in simple ignorance, has been artificially perpetuated up to the present time by Governments insisting that brown sugar should pay one rate of duty and white sugar another."

Commerce.

Cotton Supply.—Messrs. George Fraser, Son, and Co., in their monthly prices current, dated 1st April. say, "Great as was the fall in the prices of cotton during the months of January and February, it was still greater in March, and amounted to an average of 4d. to 5d. per lb. on all descriptions of long stapled kinds, and of 2½d, to 4½d. variously on short stapled. As compared with the actual prices current prior to the stock taking at the end of December last, the quotations in yesterday's Liverpool circulars are marked at nearly but slightly over one-half those prices for American, Brazil, Egyptian, and West India descriptions, but at less than one-half for Bengal, China, and other short stapled descriptions, which are comparatively neglected by spinners even at the very low rates to which they have fallen. The causes of this great decline are to be found chiefly in the belief, increased by each successive arrival of news, of the approaching end of the American war, owing to the supposed inability of the South to continue the struggle for a much longer period; and from the weakness of the holders of cotton, owing to the enormous losses sustained, and yet to be sustained, on the unsold stocks, and the supplies yet on the water, as in none of the cotton-producing countries has the price fallen in anything like the same degree as in Liverpool. There has also been great difficulty in moving any large quantity of cotton out of first hands, owing to the deadness of speculation, and to the continued cautious policy of the trade in purchasing merely to about the extent of their weekly production. To these causes may be added the general want of confidence arising from past over-trading, and the enormous losses making on all the other trading articles of produce from excess in supplies stimulated by too easy credit, and which are now bearing their natural fruit in the almost daily occurrence of large failures with the apprehension of others. Thus the Liverpool Cotton Market has been throughout the month in a state of semi-panic, and although for the moment the decline seems once more arrested, and during the last two days cotton has been in better demand, and at improving prices, there seems no feeling as yet of certainty that the improvement will, like so many that have preceded it, prove more than temporary, inasmuch as the news just to hand from America is of the same tenor as that which created the previous depression, being regarded as generally unfavourable to the South. Apart from the expectations of a speedy end to the war in America, which, however probable, is as yet very far from certain, and may so remain until one or more great battles have been fought, and their issue determined, the decline in the price of the raw material would probably be found excessive, looking fairly at the facts of the case; for, taking the actual stock, as by yesterday's stock-taking ascertained to be in Liverpool, of 580,000 bales, and adding thereto the stock in London of 126,735 bales, we have a total of 706,735 bales against 388,082 bales in those ports at the same time last year. And there are now 74,207 bales in the continental ports against 58,392 bales at same time last year. These heavy stocks account in a great measure for the weakness of holders. But when we look to the supplies on the water from India and China, a very different aspect of figures presents itself; for we find that of all descriptions the quantities now on the way are only 339,738 bales against 582,930 bales at the same period last year, or a deficiency of 243,192 bales. It is likely that this deficiency will continue to increase, especially from China, which may not improbably cease its supplies entirely when the low price is known there to which its cotton has fallen; so that there may yet be a better future for cotton if the American war does not actually come to a speedy end, as it is likely the stocks in the ports have in such case attained their maximum or nearly so, and that with the increase of consumption to be anticipated from the raw material being at half the price of three months ago, the stocks in the ports will be slowly at first, but afterwards more rapidly lessened. But this will give no stability to the Liverpool market should the expectations of an end of the American war be kept up. It is more likely in such case, that without peace, with the war still going on, and only expected to end, we may have the staple brought down to peace prices."

Royal National Lifeboat Institution.—The annual general meeting was held on Tuesday, the 14th March, at the London Tavern, the Duke of Argyle in the chair. The Institution had been enabled during the past year to increase considerably their life-saving fleet, which now numbered one hundred and forty-four lifeboats. The Committee adverted to the great loss which the lifeboat cause had sustained by the death of their President, Admiral the Duke of Northumberland, who for fourteen years had actively co-operated with them in carrying out the objects of the Institution. The most striking feature in the history of the Institution during the past year was the large number of splendid gifts, in the shape of the entire cost, amounting to £8,077 11s. 10d., of twenty-five new lifeboats, which had been presented to the Institution by philanthropic persons and collective bodies, in addition to an anonymous donation from "A Friend" of no less a sum than £5,000. During the past year the Institution had sent no less than thirty-four new lifeboats to the coast, and others were in course of construction. Transporting carriages and boat-houses had been provided, with few exceptions, for the whole of the above-named lifeboats. The lifeboats of the Institution saved no less than 432 lives and 17 vessels during the past year, nearly the whole of them under circumstances when no other description of boat than a lifeboat could with safety have been employed. For these various services, and for the saving of 266 lives by shore-boats and other means, the Institution had granted rewards amounting to £1,539. It was stated that during the last two years about 12,000 persons had been afloat in the lifeboats of the Institution on occasions of wrecks and for practice, and that only three lives had been lost during that period. The lives of between 5,000 and 6,000 persons were placed by shipwrecks on our coasts annually in jeopardy; but owing to the prompt and unceasing exertions that were everywhere

made on occasions of shipwrecks, the actual loss of life amongst that large number of persons placed in peril did not last year exceed 450 lives. Much credit was undoubtedly due to the Board of Trade for their continued valuable and cordial co-operation with the Institution. The total number of lives saved from the establishment of the Institution, either by its lifeboats or by special exertions for which it had granted rewards, was 14,266. The committee referred to the cordial continued co-operation of the local Branch Committees, the Coast Guard, and the railway and steam packet companies. Legacies amounting to £3,365 had been received by the Institution during the past year.

Colonies.

Natal.—A Natal paper thus speaks of the progress of the colony in the past year:—"Never before has industrious enterprise on the coast been so rewarded. Fact has outstripped anticipation. A series of favourable seasons has resulted in a sugar crop of unexampled abundance. From all that we can learn, after careful inquiry, it appears, that two-and-a-half tons per acre have been quite the average yield for the year. This is a yield realised very rarely to such an extent in other countries. On many estates, and those, too, that have been worked for some years, three tons and upwards have been realised. More than four tons, in a few cases, and from small patches, has been reported. Although some of the flat valley lands were touched by frost in July, the loss seems likely to be more than made up by the general goodness of the yield. It has been in many respects a good year for the sugar interest. Several new mills have been opened, and a large additional acreage has been put under cultivation. By having command of labour the planters have been enabled to extend their enterprise, and the high prices which ruled about the early part and the middle of the year tended to infuse a spirit of confidence and hope. The year's crop has probably been about 6,000 tons, or more than double what it was in 1863. Coffee culture has been growing rapidly in public estimation, and at this moment plantations are being formed on all hands. The success of the pioneers has induced others to embark their fortunes in an industry that is both pleasant and profitable, and that does not entail the wear and tear of mind and body inseparable from the larger liabilities of the sugar planter. Cotton has been less successful, and we cannot yet pronounce definitively as to the future of this staple. Small plantations continue to be carried on, and superior samples produced; but the profitableness of its growth on a large scale remains a moot question. Arrowroot is advancing again, and the few engaged in its growth find it remunerative. Tobacco, throughout the colony, is a popular product. That our soil and climate are well fitted for its culture cannot be doubted. Both in the leaf and in cigars the quality of the article has been subjected to most conclusive tests. Time and experience are the only essentials required. We have great faith in the future of this plant, and are convinced that it will supply a means of livelihood to a large number of cottage farmers, as well as a source of opulence to larger growers and manufacturers. Flax we hope great things from, and the farmers who have tried its growth are confident still that the plant will thrive when once the preliminary difficulties are overcome. But we should like to see some other staple developed. For oats and oat-hay—the great stand-by in past years—there is only a partial market, and that a local one. Wheat only does in certain localities. The soil is really so fertile, and the climate is so genial, that it cannot be doubted there are many exportable articles which might be successfully acclimatised if the attempt were only made. Stock-farming continues the popular pursuit with our up-country colonists. Sheep increase as rapidly in numbers as they improve in character. Large flocks are brought in from time to time from the other colonies, and the best blood is imported from France and England. Losses are experienced, of course, as they are everywhere, from some of those diseases to which sheep are heir, and from the neglect of proper care in sheltering them from the weather. The uplands are getting by degrees filled up with energetic young English farmers, whose efforts will, we hope, meet with success. Cattle and horse-breeding are, of course, menaced perpetually by the prevalent diseases. The character of both, however, is wonderfully improved. The beef we get now is quite different from the raw junk of old times, while in horse-flesh the introduction of some thoroughbreds has gone far to produce a very fair class of horse. On the whole, in respect of agriculture, the colony has every reason to be thankful."

Products of South Australia.—The production of copper increases steadily in this colony, and should the projected railway to the far north be constructed, mines that will not pay, with present difficulties of transit and high rates of cartage, will most certainly be worked. The wine-growing interest is being steadily developed, and will soon be one of the most important industries. It was expected that, when the Colonial Parliament assembled, a measure would be introduced allowing free distillation for wine growers, coupled with a reduction in the duty of imported spirits.

North Australia.—The government agent has decided on fixing the site of the first town at Escape Cliffs, and it has been named by the Governor-in-Chief, "Palmerston." Natives have not shown themselves in the whole of the Hotham, or, as it will now be called, the Palmerston Peninsula. It is proposed to lay out about two-thirds of the city fronting the sea at the cliffs, which is a fine healthy situation open to westerly sea breezes, and the remaining portion at Port Daly, an inner harbour between the mouth of the river Adelaide and the Narrows. This harbour is safe from all winds, and is deep and capacious. The land around the basin which forms the harbour is low, some of it covered at high water spring tides to the depth of six inches, but there are other portions of the shore which, though low, are still quite free from any tidal influences, the water being deep enough for vessels of any size to lie within a few yards of the shore. Capital only is wanted to make yards and wharves for the convenience of shipping. There is a level road from Port Daly to Palmerston not less than six miles. The whole of Adam's Bay is a sheltered harbour, and for some years to come it is probable that vessels will not enter the inner harbour, as they are almost equally safe outside in a tranquil sea, and they can discharge cargoes by lighters with great facility at Palmerston itself. The stock stations for sheep will be in the Daly ranges, about sixty miles from Palmerston, to the south, and for horses and cattle the flats on each side of the river intervening, where the country is of the richest description, covered with tall grass, which it is scarcely possible to walk through, and abundantly supplied with fresh water by lagoons and running streams, which are found on both sides of the river at intervals of less than a mile. This country will probably form admirable breeding stations, having direct water communication for sixty miles with the shipping. Wool could be produced here as profitably as in the northern runs of South Australia; and there can be no doubt but that the flats of the Adelaide are well suited for cotton. There is a white sandstone which will be found, when quarried, to produce an excellent building stone. Lime, if not abundant, can be had by burning the coral, which can be collected from any of the coral reefs which everywhere fringe the north-west coast.

Obituary.

Richard Cobden, M.P., died on Sunday, the 2nd April. He was born at the farmhouse of Dunford, near

Midhurst, Sussex, on the 3rd of June, 1804, and was thus in his sixty-first year when he died. The house in which he has latterly lived, and which was presented to him as part of the offering of the nation for his services in connection with the repeal of the Corn Laws, was built on the site of that on which he was born. Mr. Cobden's father belonged to the class of English farmers who for so long a period regarded Mr. Cobden as animated with the one sole idea of destroying their present fortunes and future prospects. At an early age he was sent to London to learn business in a warehouse, and he afterwards became a commercial traveller by accident, in consequence of having been requested to undertake the duty for one of his fellow *employés* who had fallen sick. Ultimately the houses which he represented disposed of the business to several of the *employés*, and among them to Mr. Cobden. He appears to have been successful in business, for it is stated that at the time when he first began his career as a public man his share of profits was not much short of £9,000 per annum. In 1834-5 he made a prolonged tour, visiting Egypt, Greece, Turkey, and the United States. On his return he addressed several letters, anonymously, on political and economical topics to the *Manchester Times*, and he also published a pamphlet, entitled, "England, Ireland, and America," by a "Manchester Manufacturer." The views which have now become so familiar as peculiarly his own were boldly stated in this his earliest work, namely, peace, retrenchment, non-intervention, and free trade as the true policy for England. He was elected for Stockport in 1841. Mr. Bright first saw Mr. Cobden about this period at Manchester. The Anti-Corn-Law League—then styled the Anti-Corn-Law Association—was formed in Manchester in 1838, by a body of earnest free-traders, who pledged themselves that their association should never be dissolved until absolute repeal of the corn laws had been obtained. It had its first great public demonstration in Manchester in January, 1839, and then adjourned to Westminster. On the 15th Feb., 1839, Mr. Villiers presented a petition to the House of Commons on the subject, signed by 40,000 people. His motion to hear the parties at the bar of the House was, of course, rejected, and the delegates, at the suggestion of Mr. Cobden, forthwith announced themselves as a league, pledged to agitate by every constitutional method for the attainment of their object. Money was raised, lecturers were employed to diffuse information throughout the country, and pamphlets were distributed. During several years the exertions of Mr. Cobden were unintermitting and herculean. In 1846 the free-trade struggle was crowned with success, and Mr. Cobden, who had sat as member for Stockport from 1841, was acknowledged by Sir Robert Peel as the chief reformer. It was then his old associates got up that great national subscription by which Mr. Cobden's services were acknowledged. Subsequently, while on the Continent, he received the compliment of being elected by the great constituency of the West Riding of Yorkshire. The course taken by Mr. Cobden with regard to the Crimean campaign and the Chinese question provoked much criticism, and, in common with many other politicians, he lost his seat in Parliament. Mr. Cobden filled up part of his leisure by a visit to America. During his absence a reaction set in, and he was elected in his absence for Rochdale. Lord Derby was now for some time Prime Minister, but on the return of Lord Palmerston to power, the Presidentship of the Board of Trade was offered to Mr. Cobden, but declined. The latest service which he rendered to his country was the negotiation of the Treaty of Commerce with France. It is stated that M. Michel Chevalier, on reading a speech of Mr. Bright's suggesting such a treaty, wrote to Mr. Cobden that he believed the time had come when such a suggestion might be carried into effect. Mr. Cobden took up the idea earnestly, and communicated with Mr. Gladstone, by whom it was warmly entertained, and Mr. Cobden, having subsequently seen Lord Palmerston, set out upon his mission, the success of which is so well-known. His labours appear to have been highly appreciated in France. The *Moniteur* in a recent article says:—"Cobden on his death-bed had the happiness to see the politico-economical work, so grandly understood by Napoleon III., shedding its rays over the whole of Europe, under the direction of a French statesman. Herein France was faithful to her initiatory mission. Richard Cobden was able to understand France, and he loved her. France will not forget him."

Notes.

Embellishment of Towns.—M. Warein, formerly *maire* of the town of Hazebrouck, who died a short time since, has left his property to be applied to the improvement of the place of which he was long the chief magistrate, on conditions which (presuming he had no relations) deserve to be noted for the spirit which dictated them. He regrets that the embellishment of the town has not progressed so rapidly as was hoped, and thinks that premiums offered to those who erect buildings with worthy frontages on the main streets and the grand *Place* of the town, may aid the work, and directs that during the next ten years at least that system be tried by means of the revenues from property bequeathed by him for that purpose. He says in his will that he does not desire to supply what the municipal authorities themselves are bound to effect, but to stimulate individuals to aid in the work of embellishing his native town, and expresses his belief that a few thousand francs a year spent in premiums will cause four or five times the amount to be expended in embellishments than would have been without such a spur, and that thus the working classes will each year benefit by so much additional work to be executed. If, in ten years, his executors do not find the plan to answer, they are to employ the property left in their charge to the foundation of an orphan asylum, or any other similar work not within the scope or the means of the local authorities, but to improvements which would not be effected with other means.

Model of Sebastopol.—A large plan, in relief, of Sebastopol is now being arranged in the gallery of the *Hôtel des Invalides* in Paris, where those of the fortified towns of France are placed. The plan in question is executed in plaster in twenty parts, and, when put together, will measure more than ten feet in length, and more than seven in width. It is on the scale of one in 2,000, and has been produced—from the lithographic plates attached to the journal of the operations of the French engineers, by Marshal Niel—by a sergeant of sappers, named Faure, of the Imperial guard, under the direction of Captain Riondel, who commanded a company of that division. It will be eventually placed in a portion of the Palace of Versailles occupied by the engineers of the Imperial guard.

Soldiers' Gardens.—In the House of Commons on Monday night, Mr. W. Ewart asked the Under-Secretary of State for War whether he would state, or allow a return to be made, showing to what extent the cultivation of gardens by soldiers had been adopted in the army. The Marquis of Hartington said that a circular had lately been issued by the War-Office, giving greater facilities for the cultivation of gardens by the troops, and since then several applications had been received on the subject; but as there had not yet been time for many gardens to be placed under cultivation by soldiers, perhaps the hon. member would wait a month or two longer before moving for these returns, to the production of which there would be no objection.

Correspondence.

Town Gardens.—Sir,—The very pleasant paper of Mr. John Bell, on the subject of town gardening, recals to

my mind an article I contributed to one of the early numbers of *Once a Week* on a similar subject; not on the actual gardening, but on the means of acquiring space for the garden by the substitution of flat roofs for pitched roofs, adapting the Eastern architecture of dry climates to our own moist climate by better mechanical appliances. Our pitched roofs, with steep slopes, are simply a result of our imperfect materials, and their incapacity for tight horizontal joints; were they made like ships' decks, and as carefully looked to, there would be no difficulty in keeping them tight horizontally. But even the steep pitch, though advantageous in giving a better water-shed, has its disadvantages in the greater difficulty of keeping the tiles or slates from falling down, and above all, in the interminable trouble of lead or other metal in gutters and ridges. But we have now a material thoroughly well adapted for flat roofing, and capable of water-tight joints, in sawn slate, which would, I incline to think, make, on the whole, a cheaper roof in first cost, and certainly a less costly and troublesome one in repairs, and without taking up space or elevation with a miserable "cock loft;" a receptacle for soot, dust, and bad air through a series of years. The structure of this roof would be simple. Parallel wood beams, or beams of T-iron, of sufficient depth for the load, would stretch from front to back walls, or between the party walls, at the distance apart of the slates' widths, and overhanging the walls front and back some twelve inches, with a slope either way for water to run off into hanging gutters, communicating with vertical shoots. A light iron railing, breast high or more, should enclose this front and back and along the party-walls, separating one house from another. The openings for the chimneys and the roof door should be formed like ships' hatches, with combings round them, by vertical slate ledges of sufficient depth. The edges of the slates, where abutting against each other, should be grooved in curves, and filled in with hollow piping of gutta-percha or india-rubber, forming, not a plastic caulking like that of a ship, but an elastic caulking, keeping all tight under vibration or expansion and contraction. The slates should be kept together in both directions through the whole length and breadth by light iron rods or bars below them, turned up at the ends. The lower sides of the horizontal beams should be ceiled as usual, with provision for allowing currents of air to pass freely through in warm weather, and for keeping the air stationary in cold weather, thus preserving an even temperature. In this mode what are ordinarily garret rooms with sloping sides would be square, and another floor—an open-air floor would be added to the house. To this floor water could be carried up by pipes, with or without a cistern, and be allowed to run away, after being used for irrigating gardens, as freely as on the ground surface, without any fear of leakage within the dwelling. This flat roof could be covered with a green-house all over, or with a simple vertical shelter to the north, some six feet high, possibly with a folding shelter to the east; and supposing all the buildings to be of equal height, there would be no reason why vegetation should not be as perfect as on a hill side in the country, except as regarded smoke, for the human breath ascending from below would rather act as a manure to the vegetation there than as an evil, and the vegetable absorption would get rid of the nuisance. With regard to smoke, that will gradually lessen as knowledge looms on us by the fact that smoke is wasted fuel, and that its consumption is an economy. The probable solution for this evil will be in leading the smoke into heated combustion chambers, burning away the visible products, and we know not how far the invisible gases and the wasted draught heat may yet be economised or made applicable to the roof gardens. It is quite within the range of possibility, and far from improbable, that our unsightly London chimneys may yet become objects of great beauty by being clothed in ivy, Virginia-creeper, honeysuckle, jessamine, monthly-roses, and other hardy plants. Even now such things exist in many parts of the City where fresh air blows; and a sheltered wall, with a south or west aspect, in the City, might be as pleasant at Christmas as a sea beach under a southern chalk cliff, which makes an open-air green-house on a bright winter's day, with the thermometer at 15°. Any changes of this kind with existing dwellings must be limited, but it is worth the while of builders to study the question thoroughly for future erections, especially for the workmen's dwellings which will be in process of erection at railway termini. We can imagine a future time when, with smoke and sewage thoroughly utilised, and with house-tops covered with vegetation, this our London may become the healthiest, as well as the most beautiful, city in the world. We hear much of the beauty of Paris, but it is a beauty of the barrack kind — ornamental barracks; all done to autocratic order. The beauty of London will be that of individual growth—various and yet harmonious; varying, like every human face, and every vegetable leaf and branch; the great work of nature ever expanding, and not the work of the military pedagogue, cramping everything to a small set pattern like the wooden trees of a child's toy-box. Mr. Broome says that "air draughts are very damaging to plants," very probably giving vegetables cold. But the air cistern is a still worse thing. In the business house of Rothschild, in St. Swithin's-lane, there has been for some years an attempt to attain a fore-court garden, such as we see in Spain and France, but it is a very sickly affair, apparently from want of sun and ventilation. If the garden were removed to the top of the low range of offices, it would probably thrive and might have a three feet depth of earth. It would be a pleasant thing to see the great capitalist set this pattern to a wealthy city, only needing a good example to follow.—I am, &c., W. Bridges Adams.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...R. Geographical, 8½. 1. Mr. W. E. Hickson, "On the Climate of the North Pole." 2. Mr. C. R. Markham, "On the Best Route for North Polar Exploration."

Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Captain H. W. Tyler, R.E., "On the Festiniog Railway for Passengers, as a two-feet guage, with sharp curves, and worked by Locomotive Engines."
Zoological, 8½.
Syro-Egyptian, 7½. Mr. B. H. Cowper, "Observations on Dr. Lee's Syriac MSS."
Photographic, 8.
Ethnological, 8. 1. Mr. J. Crawfurd, "On the Physical and Intellectual Characteristics of the African or Occidental Negro." 2. "On Human and Animal Remains from a Cavern near Drintion, Argyleshire." 3. Professor Busk, "On a Human Cranium from a Stone Coffin, at Phu Bodach, Bute," sent by the Rev. A. McLeod.

Wed. ...Graphic, 8.
Literary Fund, 3.
R. Society of Literature, 8½.

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 16th March*, 1865.

69. Bills—Justices of the Peace (Discretionary Powers).
73. ,, Metropolitan Main Drainage Extension.
3. (260 to 266). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 260 to 266.
65 (iv). Committee of Selection—Fifth Report.
71. Gold Coast—Correspondence.
129. Metropolitan Houseless Poor Act (1864)—Returns.
122. Dockyard and Victualling Lighters—Returns.
130. Royal Charges—Royal Commission.

Delivered on 17th March, 1865.

69. Bills—Justices of the Peace Discretionary Powers (corrected Copy).
71. ,, Courts of Justices Concentration (Site) (Amended by Select Committee).
3 (267 to 271). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 267 to 271.
90 (vi). Civil Service Estimates (1865-66)—Class VI.
121. Attornies, &c., Certificates—Return.
126. Civil Service Estimates (Votes "on Account.")
127. Pilotage—Order in Council.

Delivered on 18th and 20th March, 1865.

72. Bills—Mortgage Debentures (as amended by the Select Committee).
74. ,, Chelsea Bridge Toll Abolition.
76. ,, East India (Governor-General's Powers, &c.)
77. ,, East India High Courts.
3 (272 to 277, and 280). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 272 to 277, and 280.
43. Revenue Departments—Accounts (corrected Copy.)
66. (iv). Railways and Canal Bills—Fifth Report of General Committee.
80. Local Taxation—Return.
111. Metropolitan Police (1864)—Accounts.
112. Chain Cable and Anchors' Act (1864)—Report.
124. Courts of Justice Concentration (Site) Bill—Minutes of Evidence.
131. Spirit Duties—Report.

Patents.

From Commissioners of Patents Journal, March 31st.

GRANTS OF PROVISIONAL PROTECTION.

Agricultural implements—675—G. Wright.
Ammoniacal gas, motive power from—611—R. A. Brooman.
Atmospheric air, apparatus for cooling—636—L. Perkins.
Bags, mail and despatch—733—G. T. Bousfield.
Balls, cricket, &c.—696—C. Huntley.
Bales, hoops used in packing—663—W. J. Dorning.
Barley, machine for thrashing—793—B. J. Webber.
Blast furnaces, utilizing the waste gases of—478—J. Cliff.
Blast furnaces, hot air stoves for—666—J. Cliff.
Boxes, joints for—640—H. W. Wimshurst.
Boots, heels for—710—G. Evans.
Bricks, machine for the manufacture of—767—C. W. Spark, T. S. Cross, and W. Adkins.
Bridges, construction of—633—E. W. Young.
Burglary alarum—664—W. H. Hudson.
Button holes, machine for cutting—687—J. Garelly.
Carriages, venetian blinds for—676—T. Startin.
Carriages, disconnecting horses from—683—P. Marvaud.
Carriage ways—661—W. H. James.
Carding engines—593—J. M. Dunlop.
Charcoal, apparatus for cooling—730—J. F. Brinjes.
Cigars—595—C. L. Roberts.
Clay, preparing Kaolin or China—805—J. Wright.
Coals, &c., drying and sorting—715—F. H. Warlich.
Colour printing—721—I. Baggs.
Cotton, apparatus for dyeing—617—S. Akerord.
Cotton gins—673—E. Leigh.
Dental operations, apparatus to facilitate—706—W. D. Napier.
Drying apparatus—603—H. A. Bonneville.
Electric piles—723—W. Clark.
Explosive gases, indicating the presence of—668—G. F. Ansell.
Fabrics, manufacture of—801—W. Clarke.
Fabrics, mechanism for attaching buttons to—763—F. Wise.
Fencing, socket for—775—A. G. Browning.
Fire-arms, cartridges for breech-loading—708—F. A. Braendlin.
Fire-arms, revolving—659—W. Clark.
Fires, apparatus for blowing—755—J. Cookson and P. Billington.
Flax, machinery for preparing—680—J. Samuel and S. Millbourn.
Flax, apparatus for hackling—690—T. and H. W. Whitehead.
Flax, machinery for scutching—627—A. Potts.
Furnaces, &c.—692—E. B. Wilson.
Furnaces, puddling, &c.—700—J. Wright.
Gas burners—568—T. S. Hall.
Gas and water, connecting tubes for conveying—669—V. Delperdange.
Gas engines—731—H. Smith.
Gas burners—809—W. M. Baker.
Gasometers—781—C. H. Pennycook.
Glasses, wine, &c.—693—J. M. Napier.
Grain, apparatus for ascertaining the quality of—632—W. Bunger.
Hammers, steam—641—J. Dodge.
Hats, dyeing straw used in the manufacture of—463—E. Carchon.
Harrows, drags, &c.—739—J. Seaman.
Horses, shoes for—639—W. Clark.
Hydraulic engine, valves for—791—J. Smith and S. A. Chease.
Illuminating, vaporizing hydro-carbon for—717—G. T. Bousfield.
India rubber, cutting sheets of—656—B. Collins.
Iron safes—653—A. E. Taylor.
Iron doors—660—J. T. Harris.
Iron ships, coating the bottoms of—681—R. P. Roberts.
Iron bars, manufacture of puddled—777—R. T. Crawshay and I. A. Lewis.
Jewelry cases—803—J. J. Carter.
Keyless watches—726—H. Chevob.
Lamps—753—A. V. Newton.
Liquids, apparatus for drawing off—761—J. Walls.
Lime, hyposulphite of—765—J. C. Stevenson.
Machines, numbering—625—T. Craig and D. Carlaw.
Marine steam coilers—613—E. Humphreys.
Meat, method of preserving—645—A. C. Henderson.
Metal, engraving on—807—R. A. Brooman.
Metals, apparatus for treating—697—R. M. Roberts.
Metals, apparatus for rolling—701—R. Marsden.
Metallic bedsteads—699—J. Atkins.
Mining, apparatus for—737—J. Farrar and E. Booth.
Musical instruments—741—W. Brookes.
Nails, manufacture of—785—C. Farmer and T. Turner.
Noxious gases, traps to prevent—698—J. Bragg.
Oils, treating and purifying—732—C. Morfit.
Paper, machinery for manufacture of—581—J. Park.
Paper, machinery for manufacture of—533—J. H. Rawlins and J. Chappell.
Pipes, core employed in the casting of—587—D. Hartley.
Piston rods, packing for—647—F. Wise.
Piles, apparatus for driving—597—D. and J. Manwell.
Property, safes for securing—728—E. Loysel.
Pumps—751—J. Goodfellow.
Railway, permanent way of—386—J. and J. Porter.
Railway waggons, apparatus for coupling and uncoupling—609—D., J., and J. Morris.
Railway trains, communication between passengers and guard of—679—A. Westhead.
Safes—621—S. Phillips and J. Groves.
Safes, fire and burglar proof—695—John Tann.
Safes, &c., securing—702—H. Hill.
Sheet metal, cutting, punching, &c.—795—G. Farmer.
Shoes, manufacture of—637—A. E. A. Aubert and G. E. M. Gerard.
Smoke vents—724—T. Kennedy.
Smoking, tobacco for—615—W. E. Newton.
Steam blowers—3133—W. Brookes.
Steam generators—607—J. H. Johnson.
Steel, manufacture of—657—R. Mushet.
Steam generators—743—A. V. Newton.
Steam generating—771—J. T. Romminger.
Stones, apparatus for scouring—686—J. Hird and J. Walker.
Stockings, manufacture of—725—H. Owen.
Sugar, apparatus for refining—599—R. A. Brooman.
Surgical operations, instruments for—591—C. Rahn.
Switches, levers for railway—709—J. Deas.
Tanning, treating hides for—631—W. Clark.
Tee-piece and valve—684—C. Johnson.
Temperature, securing low and uniform—719—A. V. Newton.
Telegraphic instruments, apparatus for protecting—713—A. Bertsch.
Thieves and fire, safes for securing property from—714—E. D. Hodgson.
Toast racks—694—G. Carter.
Tubes, strengthening and ornamenting—667—E. Leahy.
Tyres, manufacture of railway wheel—665—W. D. Allen.
Vehicles, apparatus applied to—589—P. Rothwell.
Vessels, side propellers for—602—L. Thomas.
Vessel, registering the course steered by a—787—W. Arthur.
Walking sticks, apparatus for bending—682—J. and D. J. Jones.
War, ships of—509—G. Haseltine.
Water, apparatus for supplying measured quantities of—707—R. G. Rattray.
Weaving, looms for—583—S. Brooks.
Window sashes, bolts for—672—W. Smith.
Wrought iron, converting pig iron into—649—M. Morgans.

INVENTION WITH COMPLETE SPECIFICATION FILED.

Sewing machines—819—R. W. Morrell.

PATENTS SEALED.

2428. R. A. Brooman.	2498. B. H. Jones.
2438. T. T. Swinburne.	3059. E. Myers.
2441. A. Monro.	3130. B. Dobson, W. Slater, and R. Halliwell.
2456. F. Tolhausen.	3199. W. H. Maitland.
2492. J. Webster.	

From Commissioners of Patents Journal, April 4th.

PATENTS SEALED.

2458. T. Turner, jun.	2792. M. W. Ruthven.
2481. H. S. Coleman and A. G. E. Morton.	2793. E. J. W. Parnacott.
2495. T. Lambert & H. C. Soper.	2800. W. Willis.
2500. W. Gilbert, E. Cooper, and G. R. Webster.	2940. L. Valant.
2568. S. Howard and W. Wood.	3241. P. C. P. L. Prefontaine.
2574. C. Pettit.	156. S. F. Van Choate.
2585. T. Turner, jun.	204. C. T. Wells.
2627. S. S. Anderson.	209. W., R., J., and A. Woodward.
2646. P. Dutrulle.	438. G. T. Bousfield.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

863. W. A. Ashe.	1283. H. F. Broadwood.
891. W. Tyler.	892. W. H. Hook.
889. R. Young.	959. G. Moulton.
897. R. C. Ransome.	896. R. Burley.
913. H. Smith.	894. W. B. Lord and F. H. Gilbart.
917. E. Hartley, G. Little, and J. Hinchcliffe.	907. C. P. Gontard.
946. D. Wilson and E. A. Cowper.	914. J. H. Johnson.
957. L. Lindley and F. Taylor.	1010. J. and J. Bullough.
1009. G. Hollinshed.	930. B. Blackburn.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

667. E. A. Jacquin.	694. A. P. Dadley & N. Brough.
686. J. Mercer.	710. J. Fowler, jun.
692. A. Pelez.	731. R. Hornsby.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, APRIL 14, 1865. [No. 647. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

April 19.—"On the Preservation of Natural History Specimens for Museum Purposes." By B. Waterhouse Hawkins, Esq., F.G.S.

April 26.—"On the Wear and Tear of Steam-Boilers." By F. A. Paget, Esq.

Cantor Lectures.

The Third Course for the present Session will consist of six Lectures "On Some of the Most important Chemical Discoveries made within the last Two Years," to be delivered by Dr. F. Crace Calvert, F.R.S, F.C.S. (Corresponding Member of the Royal Academy of Turin; of the Société Industrielle de Mulhouse; of the Société Imperiale de Pharmacie de Paris, &c.), on Tuesday evenings, at Eight o'clock, as follows:—

April 18th.—Lecture 2.—On the Discoveries in Chemistry applied to Arts and Manufactures (*continued*).

April 25th.—Lecture 3.—On the Discoveries in Agricultural Chemistry.

May 2nd.—Lecture 4.—On the Discoveries in Physiological Chemistry.

May 9th.—Lecture 5.—On the Discoveries in the Chemistry of Rocks and Minerals.

May 16th.—Lecture 6.—On the Discoveries in the Chemistry of Metals and Alloys.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture.

Prizes for Art-Workmen.

The Worshipful Company of Salters contribute £10 annually to this Prize Fund.

The Council of the Society of Arts hereby offer prizes for Art-Workmanship, according to the following conditions:—

I. The works to be executed will be the property of the producers, but will be retained for exhibition, in London and elsewhere, for such length of time as the Council may think desirable.

II. The exhibitors are required to state in each case the price at which their works may be sold, or if sold previously to exhibition, at what price they would be willing to produce a copy.

III. The awards in each class will be made, and the sums specified in each class will be paid, provided the works be considered of sufficient merit to deserve the payment; and, further, in cases of extraordinary merit additional awards will be given, accompanied with the medal of the Society.

IV. Before the award of prizes is confirmed, the candidates must be prepared to execute some piece of work sufficient to satisfy the Council of their competency.

V. *Bona-fide* Art-workmen only can receive prizes.

VI. All articles for competition must be sent in to the Society's house on or before Thursday, the 14th of December, 1865, and must be delivered free of all charges. Each work sent in competition for a Prize must be marked with the Art-workman's name, or, if preferred, with a cypher, accompanied by a sealed envelope giving the name and address of the Art-workman. With the articles, a description for insertion in the catalogue should be sent.

VII. Although great care will be taken of articles sent for exhibition, the Council will not be responsible for any accident or damage of any kind occurring at any time.

VIII. Prices may be attached to articles exhibited and sales made, and no charge will be made in respect of any such sales.

IX. All the prizes are open to male and female competitors, and in addition, as regards painting in porcelain, decorative painting, and wall mosaics, a second set of prizes, of the same amounts, will be awarded among female competitors. If a female desire to compete in the female class only, she must declare her intention accordingly. The originals of the works prescribed may be seen at the South Kensington Museum, in the gallery at the entrance of the Sheepshanks pictures.

Casts may be seen at the Society of Arts, Adelphi, London, and the Schools of Art at Edinburgh, Dublin, Manchester, Glasgow, Birmingham, and Hanley in the Potteries.

Photographs, chromolithographs, engravings, rough casts in metal, &c., may be purchased at the Society of Arts, John-street, Adelphi, at the prices named.

The plaster casts may be obtained from Mr. D. Brucciani, 39, Russell-street, Covent-garden, W.C.

*** The Council are happy to announce that several of the works which received first prizes in the competitions of 1863, 1864, and 1865 have been purchased by the Department of Science and Art, to be exhibited in the South Kensington Museum and the Art Schools in the United Kingdom.

1st Division.

Works to be Executed from Prescribed Designs.

For the successful rendering of the undermentioned designs in the various modes of workmanship according to the directions given in each case.

Class 1.—Carving in Marble, Stone, or Wood.

(*a.*) *The Human Figure.*—One prize of £15 for the best, and a second prize of £7 10s. for the next best, work executed in marble or stone, after the Boy and Dolphin cast from a chimney-piece, ascribed to *Donatello.* Original in the South Kensington Museum, No. 5,896. Dimensions to be one-eighth less than the cast (linear).—This design may be adhered to strictly or adapted to any architectural purpose.

[Cast—Fifteen shillings; Photograph—One shilling.]

(*b.*) *Ornament.*—One prize of £10 for the best, and a second prize of £5 for the next best work, executed in marble, stone, or wood after a carved chair-back in the South Kensington Museum. Dimensions to be two-thirds of the cast (linear).

[Cast—Twelve shillings. Photograph—One shilling.]

(*c.*) *Ornament.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed in stone, after a *Gothic bracket* in the Architectural Museum. Dimensions the same as the cast. In this design the details may be improved by the introduction of small animals, and the human head may be changed according to the taste of the art-workman.

[Cast—Ten shillings; Photograph—One shilling.]

(*d.*)—One prize of £20 for the best, and a second prize of £10 for the next best, work carved in *wood* after a design by *Holbein*, as an *Inkstand* or *Watch-Holder* on three feet. Dimensions optional.

[Wood Engraving—Sixpence.]

(*e.*)—One prize of £15 for the best, and a second prize of £7 10s. for the next best, work carved in wood after the *Head of a Harp* of the period of Louis XVI., in the South Kensington Museum, No. 8,531. The head and bust only need be fully completed. Dimensions the same as the cast.

[Cast—Thirty shillings; Photograph—One shilling.]

(*f.*) *Ornament.*—One prize of £10 for the best, and a second prize of £5 for the next best, work carved in wood after an *Italian picture frame* in the possession of Henry Vaughan, Esq. Dimensions optional.—This design may be adhered to strictly or adapted in such manner as the workman may think fit.

[Photograph—Two shillings.]

(*g.*) *Ornament carved and gilt.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed in wood, carved and gilt after a *Console Table* in the South Kensington Museum, No. 6947, of the period of Louis XVI. The work to be carved roughly in wood, then to be prepared in the white by a gilder, then cut up or carved in the white by the carver, then to be gilt in mat and burnished gold. As such work may probably be executed by two persons, the prize will be apportioned as the judges may determine.

[Photograph—One Shilling.]

Class 2.—Repoussé Work in any Metal.

(*a.*) *The Human Figure as a bas-relief.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Raphael's* "*Three Graces.*" Dimensions—The figures to be six inches high.

[Photograph—One shilling.]

(*b.*) *Ornament.*—One prize of £5 for the best, and a second prize of £3 for the next best, work executed after a Tazza in silver, date 1683, the property of Sir W. C. Trevelyan, Bart., now in the South Kensington Museum. Dimensions—The same as the model.

[Photograph—One shilling.]

Class 3.—Hammered Work, in Iron, Brass, or Copper.

Ornament.—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work executed after the portion shown in the photograph of the Pediment of a Gate (German work, date about 1700) in the South Kensington Museum, No. 5,979. To be adapted for use as a bracket. Dimensions—Twelve inches deep.

[Photograph—One shilling and threepence.]

Class 4.—Carving in Ivory.

(*a.*) *Human Figure in the round.*—One prize of £15 for the best, and a second prize of £10 for the next best, work executed after a miniature statuette (Italian), No. 304 in the South Kensington Museum; dimensions—the same as the cast; or after a medallion portrait of Flaxman, by himself, No. 294 in the South Kensington Museum; dimensions—to be reduced in height by one-half (linear).

[Cast—One shilling.]

(*b.*) *Ornament.*—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work executed after a pair of *Tablets*, in the possession of John Webb, Esq. Dimensions—The same as the cast.

[Cast—One shilling.]

Class 5.—Chasing in Bronze.

(*a.*) *The Human Figure.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after a reduced copy of "*Clytié.*" A rough casting in bronze, on which the chasing must be executed, will be supplied by the Society at cost price—£2 10s.

[Plaster Cast—Three shillings and sixpence.]

(*b.*) *Ornament.*—One prize of £10 for the best, and a second prize of £7 10s. for the next best, work executed after *Goutier*, from a cabinet in the possession of Her Majesty the Queen. A rough casting in bronze, on which the chasing must be executed, will be supplied by the Society at cost price—3s. 6d.

[Plaster Cast—One Shilling.]

Class 6.—Etching and Engraving on Metal—Niello Work.

Ornament.—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after arabesques by Lucas Van Leyden, A.D. 1528. No. 18,968 in the South Kensington Museum. To be engraved the height of the photograph, and, if round a cup or goblet, repeated so as to be not less than nine inches in length when stretched out.

[Photograph—Sixpence.]

Class 7.—Enamel Painting on Copper or Gold.

(*a.*) *The Human Figure.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Raphael's design of the "Three Graces,"* executed in *grisaille.* Dimensions—The figures to be four inches high.

[Photograph—One shilling.]

(*b.*) *Ornament.*—One prize of £5 for the best, and a second prize of £3 for the next best, work executed after a German arabesque (16th century). No. 19,003 in the South Kensington Museum. Dimensions—The same as the Photograph.

[Photograph—Sixpence.]

Class 8.—Painting on Porcelain.

(*a.*) *The Human Figure.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Raphael's "Two Children,"* in the cartoon of "*Lystra,*" Dimensions—the same as the Photograph. This work is to be coloured according to the taste of the painter.

[Photograph—Ninepence.]

(*b.*) *Ornament.*—One prize of £5 for the best, and a second prize of £3 for the next best, work executed after arabesques by Lucas Van Leyden, 1528, No. 18,968 in the South Kensington Museum, and coloured according to the taste of the painter. Dimensions—Double the size of the Photograph (linear).

[Photograph—Sixpence.]

N.B.—A second set of prizes of the same amount is offered to female competitors. See conditions, Section IX.

Class 9.—Decorative Painting.

(*a.*) *Ornament.*—One prize of £5, and a second prize of £3, for a work, executed after an *ornament,* from *Castel R. Pandino,* near Lodi, from a drawing in the South Kensington Museum, No. 1,150. Dimensions—length 4ft.—width, enlarged from the print in the same proportion.

[Coloured Print—One shilling.]

(*b.*) *Ornament.*—One prize of £5, and a second prize of £3, for a work, executed after a *picture frame,* in the South Kensington Museum, No. 7,820. Dimensions—5 feet by 3 feet 11½ inches, outside measure. The works to be executed on canvass, either with or without stretchers, in cool colours. Some lines of the mouldings may be gilt.

[Photograph—One shilling and sixpence.]

N.B.—A second set of prizes of the same amount is offered to female competitors. See conditions, Section IX.

Class 10.—Inlays in Wood (Marquetry, or Buhl), Ivory or Metal.

Ornament.—One prize of £5 for the best, and a second prize of £3 for the next best, work executed after a specimen in the possession of the Hon. John Ashley. Dimensions—one-third larger than the Lithograph (linear).

[Outline Lithograph—Sixpence.]

Class 11.—Cameo Cutting.

(*a.*) *Human Head.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Wyon's* heads of the Queen and Prince Consort, on the Juror's medal of 1851.

(*b.*) *Animal.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Wyon's "St. George and the Dragon,"* on the Prince Consort's medal. Dimensions the same as the casts.

[Casts—Sixpence each.]

Class 12.—Engraving on Glass.

Ornament.—One prize of £10 for the best, and a second prize of £3 for the next best, work executed after arabesques by Lucas Van Leyden, a.d. 1528. No. 18,968 in the South Kensington Museum. To be engraved the height of the engraving; and if round a glass or goblet, repeated so as not to be less than 9 inches long when stretched out.

[Photograph—Sixpence.]

Class 13.—Wall Mosaics.

Human Head.—One prize of 10 for the best, and a second prize of £7 10s. for the next best, work executed after *Bertini,* of Milan. A preparatory drawing must be made, coloured, after the lithograph, on which the lines and disposition of the tesseræ must be marked. The dimensions of the work should be regulated by the size of the tesseræ proposed to be used, which size may be left to the choice of the artist. Although desirable, it is not necessary to execute the whole subject in actual mosaic, but if a part only be done, the eye must be in such portion. A coloured drawing, with tesseræ, may be seen at the Society's house, and in the South Kensington Museum, and tesseræ of two sizes may be obtained from Messrs. Minton, Stoke-upon-Trent, Messrs. Maw and Co., Brosely, Shropshire, Messrs. Powell and Sons, Temple-street, Whitefriars, and Messrs. Jesse Rust and Co., Carlisle-street, Lambeth.

[Lithographic Outline Coloured—Two Shillings.]

N.B.—A second set of prizes of the same amount is offered to female competitors. See conditions, Section IX.

Class 14.—Gem Engraving.

(*a.*) *Human Head.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after a cameo portrait of Savanarola, No. 7,541 in the South Kensington Museum. Dimensions—the same as the cast.

[Cast—Sixpence.]

(*b.*) *Full-length figure.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after a small Wedgwood medallion, No. 5,827 in the South Kensington Museum. Dimensions—the same as the cast.

[Cast—Sixpence.]

Class 15.—Die Sinking.

Human Head.—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after the head of the Prince Consort, by *Wyon,* on the Society's medal. Dimensions—half the size of the original (linear).

[Cast—Sixpence.]

Class 16.—Glass Blowing.

Ornament.—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work executed after an original in the South Kensington Museum, No. 1,813. Dimensions—as given in the wood engraving.

[Engraving—Sixpence.]

Class 17.—Bookbinding and Leather Work.

(*a.*) *Bookbinding.*—One prize of £7 10s. for the best,

and a second prize of £5 for the next best, work executed in bookbinding, after an Italian specimen in the South Kensington Museum, No. 7,925. The work to be bound should be some classical author of the size given. Dimensions—the same as the photograph.

[Photograph—One Shilling.]

(b.) *Leatherwork.*—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work of boiled and cut leatherwork for the outside covering of a jewel casket. Original in the South Kensington Museum, No. 7,768. Dimensions—one-half larger than the photograph (linear).

[Photograph—One Shilling.]

CLASS 18.—EMBROIDERY.

Ornament.—One prize of £5 for the best, and a second prize of £3 for the next best, work executed, either after a German example in the Green Vaults at Dresden, or an Italian Silk in the South Kensington Museum, No. 7,468, which may be adapted to a screen. Dimensions—according to the taste of the embroiderer.

[Photograph—German, Sixpence; Italian, One Shilling.]

CLASS 19.—ILLUMINATIONS.

Ornament.—One prize of £5 for the best, and a second prize of £3 for the next best, copy made from an Altar Card, attributed to Giulio Clovio, in the South Kensington Museum, No. 2,958, or from a MS. border, date 1450, No. 3,057, in the South Kensington Museum. Dimensions—one-half larger than the Photograph (linear).

[Photograph—Two Shillings.]

2ND DIVISION.
WORKS TO BE EXECUTED WITHOUT PRESCRIBED DESIGNS.

WOOD CARVING.

(a.) *Human figure in the round, in alto or in bas relief. Animals or natural foliage may be used as accessories.* 1st prize of £25 and the Society's Silver Medal. 2nd prize of £15. 3rd prize of £10.

(b.) *Animal or still-life. Fruit, flowers, or natural foliage may be used as accessories.* 1st prize of £10. 2nd prize of £7 10s. 3rd prize of £5.

(c.) *Natural foliage, fruit, or flowers, or conventional ornament, in which grotesque figures or animals may form accessories, preference being given where the work is of an applied character for ordinary decorative purposes, as representing commercial value.* 1st prize of £10. 2nd prize of £7 10s. 3rd prize of £5.

(*By order*)

P. LE NEVE FOSTER, *Secretary.*

Proceedings of Institutions.

EXAMINATIONS, 1865.—LIST OF LOCAL BOARDS.

* The Boards marked thus have been formed this year.

ABERDEEN.—Mr. W. Brebner, *Chairman*; Mr. H. Ambrose Smith; J. Cruickshank, LL.D., Prof. of Mathematics; J. S. Brazier, Prof. of Chemistry; R. Beveridge, M.D.; Messrs. W. Rattray, D. Maver, and P. Cleland. The above constitute the *working* Local Board. The following are also *ex-officio* members:—The Lord Provost of Aberdeen; the Senior Baillie of Aberdeen; the Dean of Guild, Aberdeen; John Manson; James W. Barclay, James Farquhar, John R. M'Kenzie, Baillie M'Hardy, Rev. J. Longmuir, LL.D.; Messrs. J. Duguid Milne, J. Miller, James Matthews, W. Ramage, T. Melville, W. Fraser, J. Berry, A. D. Milne, J. Bulloch, J. Grey, R. Leys, and J. Sinclair, Mechanics' Institution, Aberdeen, *Secretary.*

ALDERSHOT AND FARNHAM.—Capt. E. E. Mangles, *Chairman*; Messrs. W. H. Bayley, R. O. Clarke, Dewdney, B.A.; Sir C. W. Dilke, Bart.; Messrs. F. Eggar, T. Fabian, J. Grant; Dr. T. R. Jameson, M.D.; Mr. W. Ker; Rev. S. C. Morgan, M.A.; Capt. G. Newcome, J.P.; Messrs. B. Nichols, H. Poppleton, L.C.P.; E. Powell, S. Redgrave, Rev. Dr. Rule, Mr. J. Seymour, Dr. J. Shoolbraid, M.D.; Messrs. Sloman, C. Stroud; the Ven. Archdeacon Utterton; Messrs. T. White, T. Wonnacott, W. Hollest, *Treasurer*, and Barrow Rule, Classical and Mathematical School, Aldershot, *Secretary.*

*ALTON.—William Curtis, Esq., *Chairman*; Messrs. W. Curtis, jun., Samuel Bickerton, Edwin Williams, and John Bryant, *Secretary.*

ASHFORD.—Revs. J. P. Alcock and R. H. Wright, M.A.; Messrs. J. J. Cudworth, R. C. Mansell, T. H. Vie, J. Keener, R. Rabson, F. Garaway, and Thomas Nesbit, 3, Dover-place, Ashford, *Secretary.*

BANBRIDGE (IRELAND).—Messrs. W. Waugh, J.P., *Chairman*, R. M'Clelland, *Vice-Chairman*, J. W. M'Master, J.P., D. Leonard, J. Hawthorn, M.D., J. Smith, jun., C.E., G. G. Tyrrell, W. Walker, G. F. Long, H. Finlay, J. Noble, H. Glass, T. Connor, and Alex. Black, (*Hon. Sec.* Literary and Mutual Improvement Society), *Secretary.*

BANBURY.—Rev. H. Back, *Chairman*; Messrs. T. W. Barrows, T. Beesley, F.C.S., R. H. Brooks, W. Johnson, F.R.A.S., D. Pidgeon, and R. H. Rolls; Rev. T. Russell, M.A.; Messrs. A. B. Rye, F.R.C.S., J. Stockton, and J. H. Beale, *Secretary.*

BARNET.—Revs. F. C. Cass, M.A., *Chairman*; T. R. White, M.A., and J. D. Bell; Messrs. C. T. Carter, S. J. Baldock, W. Baldock, and John Thimbleby, *Secretary.*

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BIRMINGHAM AND MIDLAND.—The Right Hon. Lord Wrottesley, *Chairman*; the Rev. J. C. Miller, D.D.; Mr. Thomas Martineau, and Mr. Robert Wright; the Rev. Charles Evans, M.A., and the Rev. Chancellor Law; the Right Hon. C. B. Adderley, M.P.; Henry Wiggin, Esq., Mayor of Birmingham; Mr. Alderman Ryland, and Mr. Alderman Sturge; Mr. Councillor Avery, and Mr. Councillor Jacob Phillips; Messrs. W. C. Aitken, J. H. Chamberlain, J. B. Gausby, J. B. Hebbert; T. P. Heslop, Esq., M.D.; John Jaffray, Wm. Kenrick, Wm. Mathews, jun., M.A., C. E. Mathews, T. P. Salt, Geo. Shaw, F.G.S., Geo. Embrey, Samuel Grove; Edwin Smith, Birmingham and Midland Institute, Birmingham, *Secretary.*

BISHOPS' STORTFORD.—Rev. T. T. L. Bayliff, M.A., *Chairman*; Mr. J. Bell, M.A.; Rev. W. J. Copeland, B.D.; Mr. E. M. Dillon, M.A.; Revs. G. Goodman, J. Menet, M.A.; Messrs. G. A. Starling, M.D., L.R.C.P., and F. W. Nash, B.A., Birchanger, Bishops' Stortford, *Secretary.*

BLANDFORD.—Messrs. S. Abbott, *Chairman*, E. Fisher, W. E. Groves, and J. B. Green, *Secretary.*

BRADFORD.—Rev. D. Fraser, LL.D., *Chairman*; Messrs. T. Clark and D. J. Crebbin; Rev. S. G. Green, B.A.; Messrs. Godwin, J. Hanson, J. Hey, J. M. Jaques, Law, and C. Lund; Rev. W. Mitton; Mr. J. T. Newboult; Rev. W. C. Shearer; Messrs. S. Smith and A.

Smith; H. Harrison and C. Hey; and J. Simpson, Mechanics' Institute, *Secretary.*

Brighton, for Sussex.—The Mayor of Brighton, *Chairman;* Mr. J. White, M.P.; Mr. H. Moor, M.P.; Messrs. W. Furner, A. Bigge, D. Black, J. Buchanan; Rev. J. W. Cary, D.D.; Mr. H. Elphinstone, M.A.; Revs. J. Griffith, M.A.; J. D. Mosley, B.D., J. Allen, A.B., A. Creak, M.A., B. W. Harvey, W. Kelly, M.A., W. Porter; Messrs. W. King, M.D., W. Alger, J.P., W. R. Barrymore, T. Barnes, M.A., T. Barton, S. Bastick, P. Capon, C. Carpenter, J.P., A. Cobbett, A. Cox, T. H. Cross, B.A., S. Evershed, T. Page, W. H. Harper, H. E. Harris; E. H. Marshall, Dr. Lowe; Messrs. W. T. Loveday, A. Martin, H. Moor, W. Olding, T. Page, G. de Paris, J. Peto, F.R.A.S., M. Penley, W. W. Pyne, M. Ricardo, P. S. Rickards, W. D. Savage, J. H. Scott; Dr. White; Messrs. W. Slight, H. Treacher, and W. J. Williams; Messrs. Scott and Sleight, *Auditors;* T. W. Wonfor, *Treasurer;* and Barclay Phillips, 75, Lansdowne-place, Brighton, *Secretary.*

Bristol.—Rev. Canon Girdlestone, M.A., *Chairman;* Messrs. G. C. Ashmead, G. H. Bengough; Revs. T. Bowman, M.A., C. Brittan, M.A.; Mr. F. N. Budd, M.A.; Rev. J. Burder, M.A.; Messrs. I. A. Cooke, J. D. Corfe; Earl of Ducie; Mr. J. F. R. Daniel; Mr. P. H. Edlin; Very Rev. G. Elliott, D.D., Dean of Bristol; Sir A. H. Elton, Bart.; Mr. J. S. Fry, Rev. Professor Gotch, LL.D; Messrs. F. W. Griffin, Ph.D., J. S. Harford, F.S.A.; Rev. N. Haycroft, M.A.; Messrs. F. Hazeldine, B.A., M. D. Hill, C. T. Hudson, M.A., W. H. G. Langton, M.P., H. Brittan; Revs. A. Poole, M.A., J. Robertson, A.M.; D. Thomas, B.A.; Messrs. F. F. Tuckett, R. H. Webb; W. C. Seaton; Rev. J. R. Wreford, D.D.; Messrs. M. Whitwill, and F. W. Cross, *Secretary.*

Bucks and Berks.—The Hon. and Very Rev. the Dean of Windsor, M.A., *Chairman;* the Hon. and Rev. Lord W. Russell, M.A.; Viscount Kirkaldie; Revs. H. J. Ellison, M.A., W. C. R. Flint, M.A., C. D. Goldie, M.A., E. Hale, M.A., and H. Hawtrey, M.A.; Messrs. W. Johnson; C. T. Philips, *Treasurer;* Messrs. T. H. Stevens and H. Passmore; Rev. T. Rooke, M.A., *Secretary.*

Bury St. Edmund's.—The Hon. and Venerable Lord A. Hervey, *President;* Sir C. J. F. Bunbury, Bart.; J. W. Goodwin, M.D.; Rev. A. H. Wratislaw, M.A.; J. Green, R. F. Aldridge, R. Craske, and J. Jackson, *Secretary.*

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THE DWELLINGS OF THE LABOURING CLASSES IN BAVARIA.

The Society of Arts, desirous of extending to some parts of the Continent its inquiry into the statistics of Model Dwellings,* addressed, in 1863, to Dr. Von Hermann, a Privy Councillor and a member of the Bavarian Government, a request to be favoured with some account of what steps had been taken in that country towards the improvement of the dwellings of the labouring classes, and the Minister of the Interior sent out a form (consisting of a series of questions) to the Government officials in all the districts of that country. The principal points in these questions were—The name of the building; the name of the proprietor; the purpose for which the building was intended; whether plans had been published; the architect's name; the date of opening; the area covered; peculiarities of construction or internal arrangement; the materials used and their prices; the management and regulations; the rental of dwellings or apartments; the number of residents in the preceding year, and the nature of their employment; statistics of mortality and sickness; financial statement as to cost of land; price of the building and of its fittings; annual income for rent, and outlay for repairs, insurances, &c.; the repayment of debts incurred upon the building; the local influences, such as the employments of the neighbouring population and the price of labour; the number of rooms in each dwelling, their area and height, whether there are one or more stories; the sanitary arrangements; the precautions against damages, damp, &c.; rent of each house, as compared with that of ordinary dwellings in the neighbourhood; annual outlay for repairs, &c.

In consequence of this application a number of documents and plans were forwarded to the Council, the following *resumé* of which has been prepared by Mr. Gilbert Redgrave:—

The buildings described have mostly been erected by the owners of factories, for the accommodation of their workmen. In two or three cases, however, these dwellings belong to building societies, who have erected them rather from pecuniary than from philanthropic views. These buildings are invariably grouped either in rows or blocks, and offer no example of single or double cottages as in England; they have sprung up either in manufacturing or mining districts, and in towns where manufactures are carried on. In Munich, where no manufactures of any importance exist, all attempts which have hitherto been made on a speculative footing have failed, partly for that reason, and partly perhaps because the laws relating to mortgage enable the possessor of a moderate capital to obtain the requisite building funds without the interposition of any company.

* See the Special Report issued in April, 1864.

There is, however, in the suburbs of Munich a class of buildings unknown in England, parts of which may be bought by different families.

Bavarian manufacturers, finding, as a rule, that their workmen were badly lodged, and on that account unhealthy, and that the paucity of dwellings created a scarcity of workmen, have from time to time built, in the vicinity of their factories, blocks of dwellings generally offering different degrees of accommodation, and varying considerably as to rent. The reports prove that the construction of these dwellings has brought about the most favourable results. The workmen and their families have improved in health and appearance. Mortality and diseases of the chest, arising from their former ill-ventilated and badly-warmed cottages, have decreased, and a better feeling has sprung up among the men, leading to the formation of benefit societies, reading clubs, and the like.

Careful statistics are given of the outlay for the several buildings, the materials used, &c.* The rough average cost of a number of the buildings amounts to £106 6s., with a maximum of £136, and a minimum of £68 per dwelling. Many of the blocks contain from twelve to twenty families. The architect's name is rarely given, as the buildings were carried out under the superintendence of the master-workmen of the several crafts. Most of these blocks have been erected within the last few years, but one or two date as far back as the commencement of the present century. The area which each dwelling occupies varies considerably, ranging approximately from 700 to 1,000 square feet. Most of the tenements have yards, and sometimes small gardens. The houses are generally built of brick, though a few are of wood, and they are roofed with tiles or slates. Judging from the elevations which have been forwarded, some trouble has been taken to render their appearance ornamental. The dwellings are in many instances under the supervision of the proprietor or manufacturer, who causes a weekly or monthly inspection to be made by a superintendent appointed for this purpose. The buildings are, as has been stated, mainly inhabited by the workpeople of the factories to which they are attached. The average number in a family seems to be seven. In houses of this class in towns the inmates are either small tradesmen, mechanics, or the employés of railways, post-offices, &c. In a building of this kind in Nuremberg, eighteen families inhabit three blocks. There are seven artisans, seven labourers, and the remaining four are employés at the railway or the post-office. The wages of the artisans, among whom there are three joiners, two shoemakers, one turner, and one locksmith, range from 16s. 8d. to 25s. weekly. The labourers earn from 11s. 8d. to 16s. 8d. weekly, and the men employed at the railway and post, from 50s. to 84s. per month. In another return from the town of Fürth, it is stated that among twelve families there are five joiners, two turners, three metal-workers, and two belt-makers. Many of the buildings have been so recently opened, that an estimate of the annual rate of mortality is impossible, but in one instance, among a manufacturing population of 600 workmen, there has been a daily average of only 2½ sick persons; and in Nuremberg, among 98 inhabitants of a building for workmen, only one death is recorded for the year 1863. As the land on which the buildings in question have been erected forms in most cases part of the grounds attached to the factory, no price of site is given, but in Nuremberg, where a building company had to buy land, the price paid varied from 1d. and 2d. to 7½d. per square foot. In Fürth the price paid appears to have been 2s. 7d. per square foot. In some places the manufacturers give the dwellings rent-free to their workpeople, and even make provision for them in case of sickness or old age, and for their widows in case of death. By way of example, the following paragraph is given from a report, sent from the district of Middle Franconia, referring to the metal manufactory at Hammer, established in the year 1490:—"The patriarchal relationship which these manufacturers have always held towards their men, and which still continues up to the present day, in spite of the complete change which modern times have brought in this respect, has so good an effect on the community, that, although the manufacturer pays an annual poor-rate of 90s., the authorities have never been called upon to relieve any workman employed in this factory. This is owing to the fact that the manufacturer maintains the workmen and their widows in sickness and old age." Workmen so treated are certainly favoured beyond most of their class.

When a rent for the lodging is required, it varies considerably with the accommodation afforded. A foreman pays from £5 to £10 per annum for a very good house or tenement; a workman with a family has a dwelling varying in rent from £2 to £6 per annum; and unmarried people pay from £1 to £2 10s. a year for one or two rooms. The rent is paid quarterly or yearly. The repairs, which cost about 1 per cent. on the capital, are defrayed by the proprietors. The population living in the country round these dwellings consists of farmers and their labourers. The latter earn from £4 5s. to £5 a-year with board and lodging, and the day labourers from 1s. 2d. to 1s. 8d. per diem. The workmen in the factories or mines are similarly paid. The adult men receive from 8s. 4d. to 25s. per week; the adult women, from 6s. 8d. to 8s. 4d.; and the boys, from 4s. 2d. to 5s.

The accommodation varies according to the class of workpeople for which it is designed. In towns we find workshops attached to the houses, and sometimes cellarage and roof space. A foreman may have a living room, a kitchen, two bedrooms, a cellar, and a loft; workmen and their families have a kitchen, a bedroom, and a loft or cellar; and single men, or factory girls, a single room. The sizes of the different rooms in these houses appear to be about the same as in model dwellings in England. The Bavarian manufacturers being aware how much cheaper it is to provide a given amount of accommodation in a high piled building than in one occupying a comparatively large area, have adopted the system of flats, repeating the same arrangement in many floors with a common staircase.

The buildings are inspected from time to time by the proprietor or his agent, and the inhabitants are bound down to certain rules, the infraction of which will expose them to penalties or dismissal. It may be interesting to quote a few of these rules, which are obtained from the report on the cotton factory at Kolbermoor:—"Rule 4. Every part of the house, both the bedrooms and the kitchen, must be thoroughly cleaned once a week, and the windows at least once a month. The pathway in front of the house, the steps at the entrance, and the staircase, must be cleaned every Wednesday and Saturday, and this work must be performed alternately by the dwellers in the upper and lower story. Rule 5. To guard against vermin the beds must be aired daily, and the straw mattress must be filled with fresh straw in the spring and autumn. Both for the sake of cleanliness and to guard against fire, the straw must not be used loose in the bed, but must be enclosed in a proper ticking. The bedding must not be laid on the floor, but must be placed on bedsteads, or at least on trestles. Rule 9. The little garden belonging to each dwelling must be kept in good order, and be well cared for. Gardens which are not properly cultivated, or are visibly uncared for, will be taken from the family to whom they belong, and will be made over to some one else. Rule 13. No inhabitant may keep beer in casks in the house, and no business may be carried on in the house without the special permission of the manager."

These four examples will serve to show how completely these lodgings are under the supervision of the manufac-

* The average price of materials in Bavaria appears to be as follows:—Bricks, 45s. per thousand; freestone, 4d. per foot cube at the quarry; tiles, 50s. per thousand; slates, 42s. per thousand; fir timber (rough), 10d. per foot cube.

turer. The remaining rules relate to lodgers not being members of the family, to the moral behaviour of the inmates, to quarrelsome families, and to the punishments for the infraction of rules, which consist, for a first offence, of a fine of 10d., and for a second, of dismissal from the house, and even, in bad cases, from the factory. In towns these buildings are under the supervision of the sanitary police, and are subjected by them to very stringent rules.

In most cases, when a rent is taken for the use of the dwellings, it is about equal to what would be charged for an ordinary dwelling in the neighbourhood, with, however, very inferior accommodation. The model dwellings, being supplied with good stoves and good means of ventilation, are a great inducement to the workmen to leave their former wretched homes, and consequently it appears that all the buildings, however recently they may have been opened, are fully inhabited. The great difficulty in planning sets of dwellings in several stories is to ensure privacy to each family; but it does not appear that the German manufacturers have in any instance adopted the external gallery system, which is one of the best expedients hitherto imagined for attaining that object. It is pleasing to see the friendly relations which exist in Germany between the families inhabiting the same house, resulting in clubs and savings banks of the same character as our benefit societies in England. The printed rules of several of these societies, which hav been sent over, might serve as specimens for such unedertakinings our own country.

Fine Arts.

Paris Annual Exhibition.—It appears that the report that there would be no exhibition of works of art next year in Paris, in consequence of the great international gathering to take place in 1867, is incorrect, and that the annual exhibition will take place in 1866 as usual. The reason given against any break in the chain is a good one, namely that, as works which have been seen previously in public will be admitted in 1867, there will not be room for an extraordinary number of new pictures. Another reason might also have been given, namely, that the system of art education in Paris produces such an undue number of artists—good, bad, and indifferent—numbers of young men, who would be more profitably occupied in other callings, being led to study art for years, only to find out at last that they have mistaken their vocation, by the lure of gratuitous or cheap art-education —that the number of works sent for exhibition increases every year. The total number received by the jury of the *salon*, to open on the 1st May this year, is said to amount to six thousand, a larger number than the managers have ever yet had to deal with. Speaking of the annual exhibition, it may be mentioned that M. Fleury, member of the Academy of the Beaux Arts, and director of the new school, has been selected from the list of the jury elected by the artists to preside over that body.

Exhibition of Fine Arts at Lyons.—This exhibition closed the other day, and the report of the results shows the great value of these local exhibitions in France. The value of the various works sold out of the exhibition, 129 in number, amounts to more than £3,214. Of these, three were purchased by the municipal authorities for the public gallery of Lyons, for eleven thousand francs (£440); sixty-two by the Société des Amis des Arts, by whom the exhibitions are arranged, for 30,960 francs (£1,238); these also will be, in a measure, public property; and the remaining sixty-four by private individuals for 37,905 francs (£1,516). This is a result of which Lyons may well be proud. When we reflect that there is scarcely an important town in France in which something of the kind does not exist, we cease to be surprised at the dissemination of the taste for art which pervades the country.

Historical Paintings in the Hôtel des Invalides.—M. Bénédict Masson has just completed the first of his works, in the great court of the Invalides, the "Epoch of Charlemagne," which is to be opened to visitors in the month of May. The wall is being prepared to receive the second of the series of illustrations of French history.

Decoration of the Berlin Gallery.—It is said that the painter Kaulbach has very nearly completed his labours for the decoration of the walls of the Musée. It is stated that the sums already paid to the artist for material outlay only amount to about £3,720.

Photographic Exhibition in Paris.—The Annual Exhibition of Photographs is appointed to take place in the same building and at the same time as that of the pictures and sculpture, namely, the first of May.

Manufactures.

Exhibition at Bordeaux.—An interesting exhibition is announced to take place at Bordeaux, to consist of the agricultural and industrial products of France, Spain, and Portugal. The undertaking is started by the Philomathic Society of the town, with the concurrence of the Chamber of Commerce, and the countenance and aid of the French, Spanish, and Portuguese Governments, the local authorities of the department, and the municipality of the town itself. The exhibition is to occupy an extensive building, now being raised for the purpose, on the Grande Place, one of the finest public promenades in France, and its doors are to be opened on the first of July. The management has an agent in Paris.

Indelible Ink.—One more contribution to the list of new and indestructible inks, real or supposed, comes from Germany. The recipe is as follows:—20 grains of sugar dissolved in 30 grains of water, and the addition to the solution of a few drops of concentrated sulphuric acid; the mixture is then heated, when the sugar is carbonized by the action of the acid. It is said that the writing is not only of a solid black colour, but that the acid resists the action of chemical agents.

A New American Silkworm.—It appears, from *Silliman's Journal*, that after numerous experiments, Mr. L. Trouvelot, of Medford, Mass., has succeeded in rearing successfully, and in great numbers, *Attacus Polyphemus* Linn., and in preparing from its cocoon an excellent quality of silk, possessing great lustre and strength, and pronounced superior to Japanese and all other silks, except the best Chinese, by competent judges. The silk is unwound by a simple process perfected by Mr. Trouvelot, each cocoon yielding about 1,500 yards. This insect is very hardy, being found throughout the Northern States and Canada; and, as it feeds upon the leaves of oak, maple, willow, and other common forest trees, may be reared easily in any part of the country. Mr. Trouvelot has gradually increased his stock from year to year, by raising young from the eggs of the few individuals first captured, until he has at present seven waggon-loads of cocoons, the entire progeny of which he proposes to raise during the coming season. The first public notice of his experiments with this insect was given by Mr. Trouvelot at a meeting of the Institute of Technology, at Boston, about a year ago, when he exhibited specimens of silk manufactured from it, both natural-coloured and dyed.

Commerce.

New Charts of the French Coast.—The Minister of Marine has presented a report, which has been approved by the Emperor, on the necessity of a complete revision of the charts of the French coast, and a re-publication of the *Pilote Français*. The charts now in use date from 1816 to 1838, and since that time great changes have

taken place in the coast line, as well as in the profile of the bottom. It is therefore determined that the whole shall be completely revised, and it is said that the work can be completed with the ordinary means at the disposition of the Director-General of Maritime Charts and Plans, without drawing upon any extraordinary resources whatever.

United Kingdom.—Statistics of the Paper Trade.—Quantities of paper (except hangings) imported and exported :—

Years.	Paper Imported.			Paper Exported.					
				British.			Foreign.		
	For printing or writing.	Other kinds (except hangings).	Total.	For printing or writing.	Other kinds (except hangings).	Total.	For printing or writing.	Other kinds (except hangings).	Total.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
1862	115,927	73,505	189,432	93,190	36,136	129,326	9,800	3,508	13,308
1863	133,401	59,282	192,683	111,612	49,006	160,618	14,555	3,618	18,173
1864	153,054	89,553	242,607	116,071	51,734	167,805	23,452	4,986	28,438

Value of paper (except hangings) imported and exported, and quantities of rags imported and exported :—

Years.	Total Imports (except hangings).	Total Exports (except hangings).		Difference in favour of Exports.	Rags, &c., for Paper-making.	
		British.	Foreign.		Imported.	Exported British and Foreign.
	£	£	£	£	tons.	tons.
1862	420,948	441,103	31,509	51,664	23,942	4,715
1863	440,198	548,257	45,452	153,511	45,447	4,429
1864	522,447	550,092	not ascertained.	...	67,817	2,663

The foregoing figures go to prove that the British paper trade was not so greatly interfered with as was supposed would be the case, by foreign-made papers. Although the import of foreign-made papers has been steadily on the increase since the removal of the excise duty, the make and export of British papers have also largely increased. Instead of there being, as alleged, a deficiency in rags and other materials for making paper, the imports have more than doubled in the last three years, the increase being chiefly made up of exports, palm leaves and other vegetable fibres from the shores of the Mediterranean, which are found well suited for common printing papers.

Colonies.

Australian Union Benefit Society (Sydney).—From the last report it appears that the total number of members is 131; that the income of the past year was £346 16s. 4d. (of which £233 4s. 6d. was received as monthly contributions, and £113 11s. 10d. as interest), and the expenditure, comprising the medical officer's salary, sick allowances, printing, &c., amounted to £215 1s. 5d., leaving a balance in hand of £131 14s. 11d.; and that the society has the large sum of £1,785 10s. 2d. invested, bearing interest. These facts show that the society is in a prosperous state.

Port Adelaide.—The numbers of immigrants and emigrants at this port from the commencement of the year 1864 to the 14th December last, as shown by the official returns, are as follows:—Immigrants, 5,517; emigrants, 2,471; increase of immigration over emigration, 3,046. The above totals include the following, as shown in the classification adopted in the returns:—

Classes.	Immigrants.	Emigrants.
Adults, Males	2,985	1,446
,, Females	1,636	652
Children	896	373

Obituary.

John Cassell, the well-known publisher, expired at his residence in Avenue-road, Regent's-park, on Saturday, April 1st. Born in Manchester on the 23rd of January, 1817, he has died at the early age of forty-eight. Thrown in early life by the fortunes of his family among the working classes, he acquired a knowledge of their character and condition, which was the foundation of his future usefulness. He served a hard but salutary apprenticeship to manual labour, and so fitted himself to become the exponent of its wants and its claims. Realising the disadvantage of the defective education common to his class at the period of his early life, he was almost solely indebted to his own persevering exertions for the knowledge he acquired, and, in after years, so well applied. Seeing within the range of his own observation the evils accruing to the working classes from intemperance, he threw himself with all the zeal and energy of his youth into the temperance movement, which was about that time originated, and as an advocate of the cause he obtained a wide popularity, and exercised a powerful influence. Arriving at manhood, he successfully established himself in extensive commercial undertakings, and while in these pursuits his desire to benefit the classes whose educational needs he was so well acquainted with, induced him to commence, from philanthropic motives, the publication of those well-known works designed for the intellectual, social, and religious elevation of the people, and specially adapted for their requirements. These works, originating from a benevolent motive, soon formed the nucleus of what has become, in the hands of himself and his partners, Messrs. Petter and Galpin, a great publishing business. In private life he was much respected. Few men had so long a list of friends, and it included men of all ranks and conditions, by whom his friendship was considered a privilege, and from whom his gentle and noble qualities won respect and esteem.

Notes.

Mortality in France.—The Statistical Society of France has issued a statement which demands serious consideration, namely, that while the mortality of London at present surpasses the average of the last ten years, that of Paris has diminished from 31 in the thousand in 1845 to 25 in 1864. This is but a loose way of putting the case, as the general amelioration in the case of London is omitted, and only a bad year selected for the comparison. However, leaving out all question of London, it is very important to note that the rate of mortality in France has materially diminished. It appears that that of Paris fell from 3·12 per cent. in 1845 to 2·50 in 1862, and of Toulouse from 2·62 to 2·20 per cent., the last-named town exhibiting as low a mortality as the whole of France. The great towns stand in the following order with respect to mortality:—Rouen presents the highest rate, or 3·13 per cent.; then come Marseilles, Lille, Paris and Bordeaux equal, Lyon, Nantes, and Toulouse. The improvement during the period named has not been in the same ratio, but as follows:—Bordeaux exhibits a diminution of deaths to the extent of 0·89 per cent.; Lyons, 0·66; Marseilles, 0·63; Paris, 0·62; Lille, 0·50; Rouen, 0·47: Toulouse, 0·42; and Nantes, 0·32 per cent. only. One reason why Paris has not benefited in a more striking proportion still is the large influx of adults from the provinces, which naturally keep up the rate of mortality.

City Horticulture.—The Thames Embankment is already being made available for useful and ornamental purposes, for beyond the south-west corner of the Inner Temple gardens Mr. Broome is erecting a conservatory, now in a forward state of completion. These gardens will speedily possess a collection of beautiful green-house flowers on the very ground over which two months ago flowed the river.

Correspondence.

City Horticulture.—Sir,—When I introduced the subject of city horticulture to the Society of Arts, in my paper on the evening of March 29th, it was with a feeling that it was one of considerable dimensions, far beyond what I was capable of treating fully myself, and that probably the most valuable result of my remarks would be the calling out from others of observations which might be more practical as well as suggestive than my own. Now, although the general interest of the subject was illustrated by the unexpected delivery of a lecture in Westminster, on the same evening, on a branch of the same subject, Window Gardening, by Mr. Bosanquet, which doubtless took away many of those who might have been present at the Society of Arts, and have added their remarks to those given in the discussion, yet, as it was, several new facts and points of interest as well as results of practice were added, evidencing, I think, how many people are thinking on the same subject; and this is further illustrated by the letter of Mr. Bridges Adams, in last Friday's *Journal*, on "Town Gardens," which I have read with great interest. I quite accept the feasibility of his plan of flat roofing; at the same time, in this variable climate, and so high in the air as on the tops of houses, I conceive that a glass covering would be very advantageous, not only for the sake of protection from smoke and the draught, which Mr. Broome spoke of as so injurious in the Temple gardens, but that thereby an additional living or workroom of large dimensions is obtained. I have the pleasure of fully accepting the remarks of Mr. Adams as regards the beauty of Paris and that of London, and how that of the latter might be enhanced by the individual taste of its citizens; and it is for reasons like this that it is so advantageous to have the opportunity of bringing the subject before the public through the medium of the Society of Arts. It is very evident that, not only in London, but in most of the great and increasing towns of this country, this love of horticulture is rife and active, and that, separately and individually, many have been practising different points of it, without being aware of what others have been doing, and without interchange of ideas and experience. For instance, I for one was not at all prepared for the fact, as given by Mr. Broome, that within his own area of assistance there were no fewer than twenty-four floricultural societies in different parts of London, each numbering from 100 to 120 members, who held exhibitions twice a year. I dare say this was a new fact to most of those who were present that evening. This had direct reference to flower shows, which form a very pleasing department of the subject, and one which can doubtless be carried, especially by intercommunication, far beyond its present condition. But I need hardly say that the subject of City Horticulture is one that goes far beyond mere flower shows; it is one that finds sympathy in the heart of English people without show, as indeed the remarks made by Mr. Philip Palmer, Mr. Bailey Denton, Mr. George Wilson, Mr. Sowerby, Mr. Slack, Mr. Wentworth Scott, Mr. Broome, and Sir Thomas Phillips all tended to show. These few words have been called forth by those of Mr. Bridges Adams of last Friday, and I am glad to find in him a fellow-labourer in the same subject; but before I saw them I had written a few lines in reference to "Orchards in Cheapside," as alluded to by Mr. Wilson in the discussion, and which I hope I shall not be taking up too much space by asking you to append to these.—In the discussion on Wednesday evening last, Mr. George Wilson alluded to an article which appeared in one of the periodicals two or three years ago, in which the author recommended the growing fruit trees on the roofs of houses in the heart of London. Those interested in the subject of city horticulture would, I think, be glad to know the name of the periodical, and the date of the number which contained the article in question, and also whether the author had put in practice his suggestion, and if it was successful in the production of fruit. Leaves it is easy to produce. Flowers require an effort on the part of a plant, but fruit is the ultimate aim and success of its vitality. Mr. Slack's success was remarkable, in the production of such fine grapes in his glazed attic in Mount-street as he described on the same evening, and is most encouraging to those who, like myself, believe that the tops of houses in the metropolis and other large cities may be made pleasurable as well as useful, by one and the same means, that is by the use of glass instead of slate, and at no great increase of expense. An additional consideration may enter here, viz.: that by this means a portion of the enclosed contents of houses will be utilized, which often now are wasted, viz.: the pointed roofs, which are often shut off by a ceiling, and used for nothing, and are lost for any purpose, even that of ventilation; whereas, if used as suggested by Mr. Slack's experience, they would serve both for the purposes of ventilation and the growth of plants, flowers, and fruit trees. I confess also that I am anxious to hear what those who, in the habit of employing in numbers such artizans as require the best light for their work, may think of the construction of such fully-lighted and well-ventilated work-rooms in the elevated situations proposed, above the denser strata of London fog; and I venture to ask you to put this question in your journal, in the hope of eliciting practical opinions on this point. Light is also known to be productive of health in human beings as well as in plants, &c. I believe there are data showing that the shady sides of large buildings, containing a large number of occupants, are not so healthy as those which are towards the sun, and thus enjoy a larger portion of light. Also, to put an extreme case, an attic is a more healthy place to live in than a cellar, and this I apprehend does not rest only on the pure air of the former, but also on its greater degree of light. Where the young, as in the case of milliners, flower-makers, embroiderers, &c., are employed in sedentary occupation, how far more healthy would they be if working in well-ventilated, airy, well-lighted rooms, with flowers growing round them, than in stifling close rooms, where the air and occupation together are so apt to lead to consumption! It appears to me that arrangements of this kind are highly favoured by the cheap rate at which glass can be now obtained. At no other period of the history of the world and of architecture could glass be obtained so cheap. And it does not appear that we have as yet by any means fully utilized this important advantage of having at our easy and economic command a material pervious to light and impervious to weather.—I am, &c., John Bell.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Medical, 8.
Society of Engineers, 7. Mr. George King, "On Irrigation with Town Sewage."

Tues. ...Society of Arts, 8. Cantor Lectures. Dr. F. Crace Calvert, "On some of the Most Important Chemical Discoveries made within the last two years." (Lecture II.)
Civil Engineers. No Meeting on Easter Tuesday.
Statistical, 8. Mr. Hyde Clarke, "On the supposed Extinction of the Turks, and Increase of the Christians in Turkey."
Pathological, 8.
Anthropological, 8.

Wed. ...Society of Arts, 8. Mr. B. Waterhouse Hawkins, "On the Preservation of Natural History Specimens for Museum Purposes."
Meteorological, 7.
Microscopical, 8.

Thurs...Linnæan, 8. Mr. John Miers, F.R.S., "On *Gripidea*, a New Genus of *Lousaceæ*."
Chemical, 8.
Numismatic, 7.

Fri.......Philological, 8.

Sat.......R. Botanic, 3¾.

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 21st March*, 1865.

63. Bills—Locomotives on Roads.
75. ,, Bank Notes Issue (as amended in Committee).
78. ,, Chemists and Druggists.
3 (278 and 279). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 278 and 279.
107. East India (McDougall's Disinfecting Powder)—Despatch.
108. East India (Sanitary Commission)—Despatch.
134. Processions Act, &c. (Ireland)—Instructions.

Delivered on 22nd March, 1865.

79. Bills—Land Debentures (as amended by the Select Committee).
80. ,, Land Debentures (Ireland) (as amended by the Select Committee).
83. ,, Metropolitan Houseless Poor.
33. Metropolitan Board of Works—Report.
94. Opium—Return.
Schleswig, Holstein, and Lauenburg—Correspondence respecting Provisional Recognition of a Flag.
Discriminating Duties (France, Portugal, and Spain)—Correspondence.

Delivered on 23rd March, 1865.

81. Bill—Pilotage Order Confirmation (as amended by the Select Committee).
115. Navy (Crime and Punishment)—Report.
132. Park Lane and Piccadilly Thoroughfare—Correspondence.
138. Staplehurst Parish—Return.
139. Treasury Chest (1863-64)—Account.
141. Public House Closing Act—Returns.
143. Oats, Beef, and Mutton—Returns.
Charity Commission—Twelfth Report of Commissioners.

Delivered on 24th March, 1865.

84. Bills—Chemists and Druggists (No. 2).
85. ,, Tests Abolition (Oxford).
90 (II). Civil Service Estimates (1865-66)—Class II.
135. Niger River—Correspondence.
142. Unity Bank—Correspondence.
148. Chelsea Bridge—Return.
149. Thames Embankment—Correspondence.

Delivered on 25th and 27th March, 1865.

59. Bills—County Voters Registration.
82. ,, Drainage and Improvement of Lands (Ireland) Provisional Orders Confirmation.
86. ,, Roman Catholic Oath.
88. ,, Lahore Bishopric.
89. ,, Inclosure.

Patents.

From Commissioners of Patents Journal, April 7th.

Grants of Provisional Protection.

Air, stoves for heating—650—R. Howson.
Aeriform fluids, obtaining motive power from—827—M. P. W. Boulton.
Almonds, machine for peeling—760—J. H. Wathew.
Antiseptic fluids, apparatus for treating timber with—734—S. B. Boulton.
Animal matter, preparing waste—893—W. M. Fuller.
Apatite, method of treating—3—M. R. Leverson.
Bells—3177—R. Wilson.
Beer, composition for clarifying—799—W. B. Coleman.
Bottles, protective labels for—853—W. Betts.
Brushes—764—J. Vero.
Candles, machines for cutting the tips of—674—J. L. Field.
Candles, treating fatty matters for the manufacture of—817—R. A. Brooman.
Canvas, method of treating, &c.—752—W. M. Williams.
Caustic liquor—629—T. Nicholson.
Chains, ornamental metallic—843—E. Wolverson.
Cloth, preparing—762—T. Kenyon, jun.
Coal, apparatus for the distillation of—796—W. M. Williams.
Compounds, preparing lubricating—867—W. West.
Cotton gins—851—W. Richardson.
Cotton, machines for preparing—756—T. Ogden.
Deep water, apparatus for paying-out telegraph cables in—825—R. Tidman.
Designs, apparatus for indicating—815—D. Mackenzie.
Fire-arms, breech-loading—711—R. A. Brooman.
Fire-arms, breech-loading—772—J. T. Cook and J. T. Cook, jun.
Fruit, machinery for dressing—502—D. Barr.
Furnaces, apparatus for heating blast for—891—J. Player.
Gas, carburetting—596—W. R. Bowditch.
Grain, apparatus for thrashing—7[illegible]5—M. Meisel.
Hand power, apparatus for propelling carriages by—798—W. Lane.
Houses, apparatus for the protection of—619—C. F. Varley.
Human body, apparatus for measuring the—635—J. H. Wilson.
Hydrated oxide, preparation of—788—R. A. Brooman.
Iron and steel, refining—806—M. Morgans.
Iron safes—459—J. Fergusson.
Iron, machinery for working puddled balls of—779—W. Menelaus.
Japanned goods, ornamenting the surfaces of—831—T. Farmer and F. Lewis.
Knives, &c., hardening—747—H. Wethered.
Lace, manufacture of—716—J. Wilkie.
Lamp, atmospheric pressure—562—W. B. Dalston.
Light, apparatus for obtaining—841—G. F. Marchisio.
Lighting and heating, materials for—855—W. Clark.
Machinery, file cutting—885—W. Brookes.
Metals, machine for rolling—736—J. Ramsbottom.
Motive power—802—V. Baker.
Motive power engines—651—W. Clark.
Oars—161—E. D. Farcot.
Oil feeders—859—J. Buckingham.
Pasteboard, apparatus for cutting—789—W. Clark.
Pencil shield—746—C. A. Wheeler.
Piano, &c., proper action of the hands of players upon the—655—W. T. Hamilton.
Pins, fastenings for—881—I. L. Pulvermacher.
Potatoes, &c., implement for paring—857—C. Burfitt.
Railway trains, communication between passengers and guard of—839—J. C. Stovin.
Railways, permanent way of—738—W. Loeder.
Ranges, construction of kitchen—875—F. Thomas.
Reflectors—288—A. S. Stocker.
Roads, locomotive engine and carriages for common—780—A. R. Mackenzie.
Safes, locks for—778—S. Chatwood.
Scarves—773—M. Eley.
Screws, apparatus for cutting the threads of—835—J. Green.
Sea weed, preparation of—877—R. Young and C. F. O. Glassford.
Sewing machines—766—O. Robinson.
Sewing machinery—776—A. V. Newton.
Sewing machines—883—W. N. Wilson.
Sewers, &c., apparatus for ascertaining the state of—849—R. W Barnes.
Ships, cabin furniture for—829—C. Bevan.
Signals, working railway—740—R. Bell.
Spatter dashes, method of closing—658—E. Carchon.
Spindles, &c., apparatus for lubricating—782—J. W. Midgley.
Stamping, apparatus for—865—G. Bishop.
Steam, increasing the mechanical value of—748—B. Lawrence.
Steel, casting ingots of—861—C. J. L. Leffler.
Sulphurous acid, obtaining—729—A. P. Price.
Telegraph wires, posts for—749—G. Dibley and F. Braby.
Traction engines—863—J. Buckshaw and W. S. Underhill.
Turpentines, preparation of—670—J., E. G., and C. H. Freeman.
Ventilating blinds—879—H. W. King.
Vessels, compositions for coating—871—J. C. C. Halkett.
Vessels, machinery for the propulsion of—3179—J. and J. H. Fothergill.
Warps, apparatus for drying—889—R. Holroyd and J. H. Bolton.
Washing, machine for—837—J. A. Swanzy.
Weaving, looms for—845—J. Milton.
Weaving, looms for—750—J. Bullough.
Weighing machines—757—J. McConnell.
Wheel gearing—744—J. Standfield.
Wool, apparatus for combing—622—S. and W. Smith.
Wool, apparatus for washing—808—G. E. Donisthorpe.
Yarns, method of treating—490—J. Mallison.
Yarn, manufacture of—774—I. Philippsthal.
Yards, construction of ships'—873—T. Glover, jun.
Zinc, machine for cutting sheets of—662—R. G. Fisher.

Invention with Complete Specification Filed.

Iron rods, manufacture of—912—H. A. Bonneville.

Patents Sealed.

2487. J. Cassell.	2549. H. Mason.
2501. G. H. Reay.	2551. E. Baines.
2502. T. Adams & G. J. Parson.	2681. L. P. G. Bellet and C. M. P. de Rouvre.
2503. J. W. Nottingham.	157. C. D. Abel.
2508. W. B. Haigh & S. Barlow.	207. G. Haseltine.
2510. F. Wilkins.	389. T. A. & M. A. Verkruzen.
2522. E. Moride.	
2527. M. Henry.	

From Commissioners of Patents Journal, April 11th.

Patents on which the Stamp Duty of £50 has been Paid.

1008. S. Farron.	991. J. Brown.
952. J. C. Kay and W. Hartley.	1013. J. Jones, jun.
956. T. Silver.	1014. J. Langston.
972. W. Begg.	1027. C. P. Coles.
974. J. Colling.	1007. J. E. H. Andrew.
975. A. Clark.	1016. J. Knowelden.
1040. J. T. Grice.	1028. G. D. Mertens.
1052. J. Howard, E. T. Bousfield, and T. Phillips.	1029. L. Christoph, W. Hawksworth, & G. P. Harding.
1097. J. Barbour.	1032. J. Petrie, jun.
1113. J. W. Ford.	1065. N. Nussey.
1248. J. E. A. Gwynne.	782. W. Rowett.
1061. J. Park.	

Patents on which the Stamp Duty of £100 has been Paid.

760. T. Greenwood, J. Batley, and J. Dockray.	767. H. Bayley and J. Greaves.
787. S. Bickerton.	782. W. Rowett.

THE
Journal of the Society of Arts,
AND OF
THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, APRIL 21, 1865. [No. 648. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

April 26.—"On the Wear and Tear of Steam-Boilers." By F. A. Paget, Esq.

May 3.—"On Colonization; its Aspects and Results." By William Stones, Esq.

Cantor Lectures.

The Third Course for the present Session, consisting of six Lectures, "On Some of the Most important Chemical Discoveries made within the last Two Years," by Dr. F. Crace Calvert, F.R.S., F.C.S. (Corresponding Member of the Royal Academy of Turin; of the Société Industrielle de Mulhouse; of the Société Imperiale de Pharmacie de Paris, &c.), is now being delivered on Tuesday evenings, at Eight o'clock, as follows:—

April 25th.—Lecture 3.—On the Discoveries in Agricultural Chemistry.

May 2nd.—Lecture 4.—On the Discoveries in Physiological Chemistry.

May 9th.—Lecture 5.—On the Discoveries in the Chemistry of Rocks and Minerals.

May 16th.—Lecture 6.—On the Discoveries in the Chemistry of Metals and Alloys.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture.

Institution.

The following Institution has been received into Union since the last announcement:—

St. Helen's (Lancashire) Mechanics' Institution.

Proceedings of the Society.

Nineteenth Ordinary Meeting.

Wednesday, April 19, 1865; Professor Robert Bentley, Member of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Balfern, John Edward, 6, The Lawn, Shepherds'-bush, W.
Bedder, William, Saltash, Cornwall.
Boroschitzky, J. F., 32, Tavistock-place, W.C.
Botly, William, Salisbury Villa, Upper Norwood, S.
Buckley, R. S., Mossley, by Manchester.
Clever, Joseph, 7, Coleman-street, E.C.
Cozens, Samuel E., Phœnix Wharf, Southwark, S.E.
Davison, Thomas Langmore, 2, Lavender-terrace, Lavender-hill, S.W.
Edwards, Samuel, 13, Limes-grove, Lewisham, S.E.
Green, John, 2, Gloucester-place, Lower Tulse-hill, S.
Hawke, John, 3, Brockley-villas, Brockley-road, New-cross, S.E.
McClellan, Samuel, 7, Cambridge-terrace, Upper Lewisham-road, S.E.
Shanks, James, St. Helen's, Lancashire.
Skelton, John, jun., M.D., 105, Great Russell-street, W.C.
Taplin, Thomas, 14, St. James's-square, S.W.
Westhead, Albert, 20, George-street, Hanover-square, W.
Westhead, Edwd. S., 20, George-street, Hanover-sq., W.
Wilkinson, T. L., 1, York-villas, Sydenham-park, S.E.
Wynne, F. Osborne, Archcliffe-street, Dover.

The following candidates were balloted for and duly elected members of the Society:—

Austin, Charles E., 7, Broad-sanctuary, S.W.
Bradley, E. B., 1, Church-meadows, Sydenham, S.E.
Brown, George, Bruckwood-house, Croydon, S.
Buckney, Thomas, 12, Brunswick-square, Camberwell, S.
Canning, L., Abbey-wood, S.E.
Chambers, W. Oldham, Lowestoft.
Cooke, Rev. John Hunt, Elm-grove, Southsea.
Costeker, John, St. John's-hill, Wandsworth, S.W.
Da Silva, Johnson, Burntwood, Wandsworth-common, S.W.
Laslett, Thomas, Devon-house, Maryon-road, Charlton, S.E.
Lewin, William Henry, 135, Southampton-street, Camberwell, S.
Lloyd, Percy, Ash-villa, Burnt-ash-lane, Lee, S.E.
Lucas, Charles, 9, Louvaine-road, St. John's-hill, Wandsworth-common, S.W.
Massey, Hugh H., 33, Camberwell-green, S.
McArthur, Alexander, Raleigh-hall, Brixton-rise, S.
McEwan, James, 38, Cannon-street, E.C.
Nagle, Rev. W., 1, Blackheath-villas, Blackheath, S.E.
Parker, Thomas, 10, Brunswick-square, Camberwell, S.

The Paper read was—

ON THE PRESERVATION OF NATURAL HISTORY SPECIMENS FOR MUSEUM PURPOSES.

By B. Waterhouse Hawkins, Esq., F.G.S.

Museums have during the last 25 years become so important an element of civilization and education that they form a subject for discussion quite within the true province of the Society of Arts, and the first question I would suggest is—Do the natural history specimens in their present state fulfil their purpose of teaching, and of assisting the public to appreciate the advantages of a knowledge of natural history in any proportion to the vast cost of their collection and preservation?

The late Prof. Edward Forbes, in a valuable pamphlet on the uses of museums, says—" It is to the development of provincial museums that we must look in future for the extension of intellectual pursuits throughout the land." He then goes on to say, " When a naturalist goes from one country to another his first inquiry is for local collections. He is anxious to see authentic and full cabinets of the productions of the region he is visiting, and, if possible, to study them apart and not mingled with general or miscellaneous collections."

" For general affinities of objects that concern the whole world he seeks the great national collections, such as the British Museum, the Jardin des Plantes, and the Royal Museums of Berlin and Vienna, but that which relates to the particular locality he is endeavouring to become acquainted with, he expects to find either in a special department of the National Museum or in a separate establishment, the purpose of which is, in a scientific sense, patriotic and limited. In like manner, when the inquirer goes from one province to another he seeks first for local collections. In almost every town of any size or consequence he finds a public museum, but how seldom does he find any part of that museum devoted to the illustration of the productions of the district. The very feature which of all others would give interest and value to the collection, which would render it most useful for teaching purposes, has in most instances been omitted or so treated as to be altogether useless."

The public attention is now so much occupied with fish culture, not merely in the natural history sense, but also for economic purposes, as an article of food, and of commerce, and, therefore, legitimately within the scope of the direct action of the Society of Arts, that I need not give any other reason for commencing with this portion of my subject—the preservation of fish specimens.

The animal kingdom is divided into two great classes, the invertebrate, comprising the molluscs, the radiata, and articulata, of which I do not intend to speak—and the vertebrata, commonly known as birds, beasts, and fishes, which will form the subject of my remarks. This is, however, not a lecture on natural history, and I need not, therefore, enter into a description of the construction of the vertebrata, except to point out the fact that they have bony frames, to which muscles and tendons are attached.

Anglers and others interested in fish have often applied to our museums to see a complete collection of preserved specimens, but even at the British Museum, which is first in cost to the nation, first in size, and first in the vastness of the number of specimens it contains, such a collection of fish is not to be seen by the public. There are two modes of preserving fish: in spirit in bottles, and by dried skins fastened to a slab, or the whole stuffed in the true sense of the word; to which, colour, varnish, and glass eyes are added to complete the life-like aspect of the "fish out of water." Neither of these processes gives much idea of the appearance of the fish while living, and specimens thus preserved are not of so much use in a natural history point of view as a skeleton of the fish would be.

In the spirit bottle the whole of the fish is preserved; but this method has many disadvantages, which render it useless as regards the general public. What is required for them is a collection in which they can, at a glance, see the various differences between herring and pilchard, char and salmon, &c., and become acquainted with the modifications of form peculiar to the various kinds of fish.

One disadvantage is that the convexity of the sides of the spirit bottles deforms the objects seen through them, so that specimens preserved in this manner are only of use to the naturalist, who removes them from the bottles for the purpose of minute examination. To obviate this I propose that flat-sided glass cases or boxes should be used. Experiments were at one time made with flat sided glass cases at the Museum of the College of Surgeons, and at the British Museum, but these failed to be satisfactory; the fluid used was Goadby's solution (spirit being then too expensive even for our national collection), which expands with every variation of temperature, and it was found impracticable to seal the cases so hermetically as to prevent the solution from oozing through the crevices, and not only producing an unsightly appearance and destroying other specimens, but also admitting the air to the specimens in the case.

I have lately seen a slate frame, of a very simple construction, invented by a talented engineer, which is held together by iron bolts, in the same manner as a slate cistern, and which would, when fitted with plate glass sides, form a hermetically sealed case, in which the specimens of fish could be admirably displayed. These cases could be erected as a double screen, each being of about 9 inches, or the whole 18 inches in width, just wide enough to contain the body of the fish, and thus occupying a smaller amount of space, and giving a better view of the specimens than has yet been afforded by any other method. The specimens in bottles would still be retained for the use of the naturalist, and thus both requirements, the instruction of the general public and the inquiries of the scientific man, would be satisfactorily met. The remarks and suggestions which I have made with reference to fish apply equally to all other animals living under water and to reptiles.

Of all the classes of animal preserved in museums, the most successful, or rather the least objectionable in appearance, have always been the birds. The exact arrangement of the feathers of birds preserves the natural appearance, even if the skin be supported merely by a wire frame; but such specimens generate the destructive moth, to the detriment of the rest of the museum collection. This modification of my praise of preserved birds, must not be applied to the specimens prepared by Mr. Gould, Mr. John Hancock, or Mr. Charles Waterton, who possess no ordinary amount of artistic power as well as being eminent naturalists. In the Great Exhibition of 1851 a large field was opened to the taxidermist. In the Sardinian department there was " a remarkable specimen. It exhibited to perfection the art of representing the living animal, not only in its general form and character, but marking also the fine and delicate undulations of the flesh and muscles, and all the anatomical details which are externally traceable. The difficulty of effecting this is so great, that generally it is scarcely attempted, but in this instance the artist had been most successful. The process adopted by Sig. Comba, the exhibitor of this specimen, has been that of modelling the animal in clay, and from that model forming a mould. This mould enabled him to construct a figure of a material resembling papier-maché, retaining all the fidelity of the original model. Upon this figure the skin was stretched." Besides this artistic specimen, which obtained a prize medal, there was a collection exhibited in 1851 by Ploucquet, of Wurtemburg, consisting of a " series of scenes taken from Kaulbach's illustrations of the well-known German story of 'Reynard the Fox,' and executed with great skill, expression being thrown not only into the attitudes, but even into the countenances of the animals." The skins of some of the larger specimens exhi-

bited by M. Ploucquet were stretched over plaster models. Mr. Bartlett's specimens of birds obtained a prize medal in 1851, as also those exhibited in 1862 by him and his pupil, Mr. F. W. Wilson. Mr. John Hancock exhibited several single specimens and groups of birds and animals in 1851 which were "most truthful as to the representation of the habits and appearance of those creatures, and in every respect of the highest merit," and obtained a prize medal.

We have seen, then, that papier maché was adopted for that admirable model of the elk, from Turin, sent to the Exhibition of 1851, by Sig. Combà, which so justly received the medal. I have a vivid recollection of the beauty of that work, and am confident that the process by which it was produced might be safely adopted for all the models that may be required henceforth in our museums; indeed, I can state that successful experiments, in the use of papier maché, have been made by Mr. Bartlett's pupil, Mr. Wilson, at the Crystal Palace, the lightness and plastic nature of the material affording many facilities for the reproduction of the true form. Its cleanliness also adds much to its value, and the facilities for attaching the skin to the concavities by means of any of the cold liquid glues now in use, render the paper model the most hopeful means for the improvement of taxidermy that has yet been suggested. In the large group of stag and dogs, exhibited in 1851, and afterwards in the possession of the Crystal Palace Company, some of the skins were stretched over plaster of Paris casts, taken from the body of the animal immediately after the removal of the skin, but this material is too heavy and brittle for general use.

If, then, the majority of our museum specimens are not at present good, how can they be made better for the future? The preservation of animal forms is one of the most ancient arts still practised. Its most primitive form was the embalming of the dead bodies without removing the internal parts. The Greeks and Romans adopted the still more crude method of dipping the body in melted wax, which disguised the form. These preparations were made in Egypt, Greece, and Rome by the priests who collected them in the temples, but the idea of a museum of natural history originated in Italy, and it was the collection of an Italian amateur of this science, which, after several changes of hands, formed the nucleus of our British Museum. Though to the question, "What's in a name," there is a stereotyped answer, about a rose by any other name, &c., I believe that the first step towards improving the character of our museum specimens would be for the taxidermist to recast his name, and drop the title of "stuffer," "bird stuffer," and "beast stuffer," which suggests only a kind of natural history upholstery, little above the stuffing of a chair cushion. If he adopted some more elevated title, a higher class of work would be expected of him, his specimens would be subjected to artistic criticism, and a higher price would be paid for them; we should thus obtain ten good well preserved specimens of typical natural forms for every twenty or thirty of the ill-looking grotesques that are now so closely packed in the costly plate-glass cases of the British and other Museums.

By "well-preserved specimens" should be understood well modelled restorations of the animal's real form as in life, in a quiet attitude, at which the spectator could gaze contentedly for some minutes without that feeling of impatience for the creature to move which is excited by beholding an animal set up in the action of a spring or leap, which in life it could only maintain for a moment of time.

The production of well-preserved specimens of this standard is not so easy a task as may be supposed by the inexperienced spectator. It is easy to condemn a stuffed animal as unlike the living thing, while others suppose that it cannot be wrong because it is the thing itself. The actual skin (say they) and the greater part of the bones, are there, and, consequently, it only requires a little tow or other yielding material to be put between the bones and the skin to replace the flesh, the size of the skin being the guage or measure of the quantity. The skin is carefully and closely sewed up when full. This is the operation of stuffing, as it has been practised for many years.

The difficulties which the stuffer has to contend with are tolerably evident in specimens now exhibited. These skins of deer, antelopes, and the wild ass from Persia are a very fair average of the state in which the best skins are received from abroad—hard, shrunk in every direction, contradictory of the original form of the animal, sometimes preserved by applying turmeric, sometimes tanned, yet stiff and unmanageable, like some of the other specimens present. The stuffer has to cleanse and soften the skin as the preliminary step to his future operations; then, having made out the species or its affinities, he has to make his measurements very carefully, with considerable deductions and allowances for the stretching of the skin in the direction in which it may have been hastily pulled from the body of the animal; this hasty method of skinning the animal has generally the effect of elongating the skin in one direction, viz., the length of the animal, while of course the width or circumference of the body is disproportionately reduced, as the exhibited examples will demonstrate. It will therefore be seen, that the stuffer has to remedy deformities before he can construct the hard frame work that is to unite with the bones already there, being left in the skin, as the thigh, the tibia, and tarsal, with the metatarsals that constitute the bones of the foot, or he may have to make an entire frame or substitute for the skeleton, upon which he must place the rest of his model, having the numerous convexities and concavities that shall faithfully represent the bulk of the muscles and sinews covering the bones of the animal as he appeared in life. This is but preliminary; he has then to make the skin fit his model in every part, or perhaps it would be more correct to say that he has to make his model fit every part of the skin, in spite of the deformities contracted in the first act of skinning, whereby it has been both stretched and shrunk, while the latter effect has been increased to an almost unlimited extent, by the drying process that commenced suddenly in the tropics, and has been continued during a long voyage.

The eye was formerly treated as a mere glass button, without any regard whatever to true imitation of that organ itself, either in colour, form, or expression. In 1848 I was induced to take up the subject, and at my suggestion eyes of an improved character were formed of glass, which enabled the artist, by means of painting and the use of various coloured silks and a backing of velvet, to produce an artificial eye which should accurately imitate the real eye of the animal. These eyes are now getting into general use, for I did not patent the invention, and they are very cheap. Formerly the only good artificial eyes were to be had in Belgium, and were very dear, costing frequently as much as £2 for a single pair of eyes, and even then it was not in the power of the stuffer to adapt them specially to the subject in hand.

With such materials and opposing difficulties, I maintain that the stuffer of birds and beasts ought to be something more than a stuffer, for he has a more arduous task than the sculptors' modeller, who imitates the external form of a living animal, with more or less knowledge of the internal anatomy or framework. If, then, the stuffer's work is to be expected to bear comparison with the work of the artist modeller, the many greater disadvantages that the stuffer has to contend with, and the ingenuity he must possess to conquer them, should be taken into account, and, as greater skill and better education are required, a higher remuneration and rank should be accorded to the artistic workman who shall at all times prove himself competent to adapt the distorted skin to a correct artificial model, possessing the true form of the animal so preserved. Whenever this style of preserving specimens of natural

history can be accomplished for museum purposes we may then contentedly forego the motley crowd that now fills the costly glass cases at our national museum and unprofitably occupies the valuable space of those large rooms, pronounced insufficient for the continuous influx of stuffed specimens, but which might be large enough for well-selected typical forms, having the real skin put upon a life-like model, side by side with a type skeleton of the group, from which the artist, sculptor, or painter could derive instruction sufficient to qualify him to continue his studies from the living animals belonging to the Zoological Society, who, in their liberal wisdom, have always allowed artists free access to their collection. Then we should have our art-students in possession of the same facilities for the study of animal forms as are possessed by the student of high art. The museums containing true models of various animals, in lieu of the present style of stuffed specimens, would be to the animal painter the equivalent of the casts from the antique, to educate him gradually to take advantage of the animal life academy always to be found at the Zoological Gardens.

DISCUSSION.

Mr. G. F. Wilson, F.R.S., said Mr. Hawkins, in his very interesting paper, had spoken of the preservation of specimens of fish. Ten years ago he (Mr. Wilson) tried a great many experiments with what was then a new medium, viz., glycerine. He tried the effect of this on a large lake trout, which he caught in Scotland, and enveloped in a cloth saturated with glycerine, in which it was kept in a good state of preservation. It was afterwards presented to Prof. Owen, and placed among the objects of this character in the museum of the College of Surgeons. He had understood that the same medium had been used by Dr. Carpenter for the preservation of star-fish. He should be glad to hear Mr. Hawkins's opinion as to the advantages or disadvantages of the use of glycerine for the preservation of this class of object.

Mr. George White said the subject which had been brought before them in so interesting a manner naturally suggested the inquiry how museums might be made educationally valuable. The wants of the scientific inquirer and of the artist had been more or less considered in our museums of natural history; but there was one point to which the prominence it deserved had not been given—that was the general educational uses of these establishments. They had heard this evening that the British Museum was not so largely visited by the public as was formerly the case. He was not at all surprised at that fact. As the natural history specimens there got dingy and dusty, and as people came to know more about them, and as, moreover, they could often see better specimens in other museums, it was not surprising that our great national collection was not attended by such large numbers as was the case some years ago. Mr. Hawkins had made the remark that there was no class of specimen in which they had succeeded so well as in birds; with great deference he thought they were amongst the most unsuccessful portions of the museum. When a boy he (Mr. White), like most others in the country, amused himself a great deal in searching the hedge-rows for birds' nests, and acquired a large collection of eggs; he also practised to some extent as an amateur taxidermist, and it was a great prize to him when he alighted upon a book on that subject. He then gratified his tastes by preparing specimens of the birds of the locality in which he resided, and it was not till he was a young man that he visited the British Museum. When he first went there he must say he was disappointed with a great number of things he saw. He was recommended to go again, and to confine his attention to one particular class of object to which his tastes inclined. At that time there were scarcely any birds' eggs in the museum, and with regard to the birds themselves, he put the question to himself, "Do all birds sit upon sticks in one unvarying attitude? and are they all constantly sitting with their wings closed, and their bills pointed in one direction?" He was surprised to see whole regiments of water wagtails, tom-tits, and yellow-hammers, set in rows above each other, all exactly alike; and he could learn no more from looking at twenty or thirty than he could from looking at one. Then he was struck with the thought, "How little all this exhibition teaches me." At the time he spoke of there was no classification of the birds, and the labelling was extremely imperfect. An alteration had taken place in that respect, but very great improvements were still required. Instead of having thousands of birds stuffed, as a cook might do for roasting, he would have them in fewer numbers, well classified and labelled, and placed in natural postures. These might be varied to a great extent. For instance, the birds might be represented as flying to and from their nests, giving food to their young, &c. He had seen nothing which had given him satisfaction in this respect since the Exhibition of 1851, and in comparison with 1862 he decidedly gave the palm to 1851. The expression and attitudes of the birds and animals shown there were Landseer-like, and all the features of life were admirably preserved. On this subject he believed a great work might be undertaken by this Society by the exercise of its influence to render museums of national history more educationally interesting and entertaining to the masses who visited them.

Mr. J. Beavington Atkinson had not intended to make any remarks on the subject treated by Mr. Hawkins in his most interesting and instructive paper, but he had been induced to rise because a point had been raised in it which had involved a subject in which he had long felt special interest—that of art and the connection which existed between science and art. The points to which they had had their attention directed were of great practical importance, and the few remarks he should make would have relation to that part of the subject with which he was more particularly concerned. It was related in the life of Haydon, the painter, that he and his pupil, Sir Edwin Landseer, made a careful dissection of a lion, as a necessary part of the education of an artist, showing, as had been pointed out by Mr. Hawkins, how strongly these distinguished men felt that a thoroughly educated artist had something more to do than to attend merely to the gloss on the skin or the texture of the hair, and must necessarily study the anatomy of the animals which he painted. Some of the marbles in the Vatican afforded the strongest evidence that artists in ancient times paid attention not merely to the superficial texture of the skin, but to the accurate configuration of the body of the animal represented. Coming down to the present time, he might call attention to a recent work on the camel,* by Elijah Walton, which was the result of really diligent and careful study of the animal, and the value of which to artists and students of natural history could hardly be overrated. The artistic advantages of really correct drawings of this animal had been recognised by artists and critics. Many of the drawings of the late distinguished artist David Roberts possessed, no doubt, very high merit, but when he attempted the delineation of the camel, he failed to show that accurate knowledge of the anatomy of the animal which was manifest in the works of another great artist, Lewis. The art value of the drawings of the latter was immeasurably greater, simply because he understood the structure of the camel. He might further refer to a painting which they would see at the forthcoming exhibition of the Royal Academy, by Frederick Goodall, R.A., the subject being, "A Flood upon the Nile." In that painting they would see an accurate delineation of the camel — a most difficult animal to draw, because, although pronounced in its articulations, yet in its movements most loose

* "The Camel; its Anatomy, Proportions and Paces." By Elijah Walton. (*Day and Son.*)

and undecided. There was this obvious connection between the study of anatomy and art, so that a picture might in fact be looked upon as a work of science as well as of art. He thought what they had heard this evening enforced a truth which they were more and more ready to admit—that the highest science was the best and truest art; and that in accuracy of detail, which in previous years had been considered to belong only to the man of science, would the artist find his highest beauty.

The Chairman said it was now his pleasing duty to propose that the thanks of the meeting be given to Mr. Hawkins for his paper, which he had no hesitation in characterising as one most interesting and instructive, and he trusted it would lead to valuable results. Having been a pupil of the late Professor Forbes, he well recollected his crushing denunciations of the different museums he found in passing through the country, and his regret that these local establishments could not be made strictly educational, more particularly as illustrating the natural history of the locality, a view advocated by Mr. Hawkins this evening. No doubt the great difficulty in all museums had been the fact of the inartistic way in which the natural history specimens had been preserved, in no degree resembling the animal itself, or the form of any living object whatever; but if these objects were placed before them in a really satisfactory form, as might undoubtedly be done, though it would require a great deal of time and skill to do it, the museums would be more frequented than they were at present, and would be more valuable in an educational point of view. With regard to the statement that the numbers visiting the British Museum had very materially diminished, it was to be borne in mind that some few years ago it was the only exhibition of its kind in the country; whereas now there were the collections at South Kensington, the Crystal Palace, and elsewhere. Moreover, when they saw such inartistic specimens as that exhibited this evening as a fair type of what was to be met with in the national collection of zoology, it was not to be wondered at that, with the improved taste of the age, such a collection should lose its attractions. He regretted that the subject before them was one on which he had but little practical knowledge, his own department being more especially the vegetable kingdom. Hitherto the miserable dried specimens of plants usually seen were of little value to the scientific man; to those who desired to know what the plant really was they conveyed no idea. He was happy to find that a great improvement in this respect was to be looked for, owing to the modifications introduced by Mr. Ward, the well-known inventor of the Wardian case. His idea was to arrange the entire vegetation of a particular mountain or district in such a manner as to be valuable to the man of science as well as gratifying to the general visitor. Specimens either of the animal or vegetable kingdom, had no value unless they gave some correct notion of what the objects represented really were in their natural state. He should have been glad to have heard some further discussion with respect to preservative substances. He agreed with Mr. Hawkins that Goadby's solution was not satisfactory, and the only reason it was formerly used was on account of the great expense of spirits. He believed methylated spirit, with three parts of water, was the best liquid that could be employed; while for vegetables and plants, salt and water, vinegar and water, or dilute pyroligneous acid, answered well, one special advantage being that they preserved the colour. He was sure the meeting would unanimously agree that their thanks were eminently due to Mr. Hawkins for his paper, and for the peculiarly clear and artistic manner in which he had illustrated his subject on the black canvas.

The vote of thanks having been passed,

Mr. Waterhouse Hawkins, in acknowledging the compliment, expressed his regret that in our National Museum the intending emigrant and colonist sought in vain for properly classified specimens of the animals, birds, &c., to be found in the new country to which he was going. He thought the Society might assist in obtaining something like a geographical arrangement of this kind, showing, even if only on a small scale, the animals of New Zealand, Australia, &c. Such an exhibition would be of great value to those going out as emigrants or as collectors, and would prevent the latter sending home useless things for want of that knowledge which might be obtained in a well-organised museum.

Mr. Hawkins illustrated the various points of his paper by sketches in chalk on the black board, and exhibited a collection of stuffed animals showing defective as well as meritorious work of this kind.

DUBLIN INTERNATIONAL EXHIBITION.

The interior of the building now begins to present a very busy aspect, the works of the contractor in painting, decorating, glazing, &c., being completed, and gas-pipes having been laid throughout the building; the business of the exhibitors has begun in earnest, in fitting up cases and arranging counters, goods, &c. The court in the Indian gallery has been railed in preparatory to the work of fixing cases and opening packages. In the Colonial gallery the courts and counters are all up, and we see packages from Canada, Nova Scotia, Mauritius, Natal, Jamaica, West Africa, Falkland Isles, Ceylon, Queensland, Siam, &c., waiting to be opened.

Among the commissioners, &c., already present or on their way are Mr. James Morris, representing Mauritius; Dr. Forbes Watson, India; Mr. Tyndal Bright, Victoria; Rev. Dr. Honeyman, Nova Scotia; Mr. A. Ferro, Malta; and Mr. W. Hewitt, China and Japan.

The preparations for the due reception of His Royal Highness the Prince of Wales, who will stay with Lord Wodehouse, are progressing rapidly. The musical performances at the opening on the 9th of May, with nearly 1,000 voices, will be very effective. A grand ball will be held in the building on the 12th, to which only season-ticket holders and members of the Musical Society with which it originates will be admitted. The Grand Lodge of Ireland also proposes to give a masonic ball if the Prince remains long enough. The grounds of the Palace are already beginning to wear a more finished aspect, consequent on the fine weather; and conservatories, blocks of coals, obelisks, fountains, and other objects for which room cannot be found within the building are to be accommodated there.

Work has commenced in the foreign courts. M. Corbière, the representative for France, has already got his court in preparation in the centre of the building. Germany, Italy, and other states are also at work, their goods having arrived. The picture galleries begin to wear an attractive aspect.

The Queen of Spain has named six gentlemen as Royal Commissioners for that country; and about fifty pictures from the National Gallery at Madrid are on their way to Dublin.

It has been determined that the jurors for the several classes shall be selected by the Executive Committee from the recommendations of the several committees and representatives of foreign countries, and in accordance with the wishes of the exhibitors. This mode of selection has been considered preferable to the direct election by the exhibitors, of whom it is not to be expected that a large proportion will be present in Dublin at one time; the difficulty of collecting their suffrages, and of obtaining anything like agreement among them, where there was no opportunity for previous meeting or consultation, was sufficiently apparent in 1862; and the unsatisfactory results of the system then adopted have induced the Committee to assume the responsibility of nominating the jurors, taking care to consult the wishes of the exhibitors, and to seek for the assistance of the most competent men in

every department of science and manufactures, both at home and abroad. With this view the several foreign committees have been requested to submit the names of such of their countrymen as they would recommend for the office, and who are likely to visit Dublin for the purpose of performing the duty. The design for the medal is by the celebrated medallist, William Geefs, of Brussels. It is a handsome composition, representing the Spirit of Progress in Arts and Manufactures enriching Ireland from a full cornucopia, while a view of the building in the background and various emblems of industry mark the year as an epoch in the improvement of the country.

The leading railways have already conceded a reduction of 25 per cent. on the ordinary return fares, and it is hoped will yet run cheap excursion trains to induce numbers to visit the Exhibition and the lovely lake scenery of Ireland in the autumn. The city is painting and putting on its brightest aspect for the occasion, and a register of the charges for lodging and hotel accommodation has been established at the inquiry office in the building. The steam packet companies have reduced the charges considerably on goods intended for the Exhibition. The Royal Dublin Society has conceded the use of its premises for such agricultural implements and goods as cannot be accommodated in the Exhibition building; and altogether the arrangements thus far promise a very great success for this second International Exhibition originated in Ireland.

THE SEWAGE OF TOWNS.

The Sewage Commission, consisting of the Earl of Essex, Professor Way, Messrs. Bobert Rawlinson, J. Bennet Lawes, and John Simon, have just issued their report, which states that since the date of the last report (August, 1861) the commissioners have, through a committee, consisting of Mr. Lawes and Professor Way, continued at Rugby the experiments which were undertaken in 1861 on the application of sewage to land. These experiments have not been confined to the application of sewage in different quantities to land, but have extended to the consumption, by cattle, of the produce so obtained, and to the production of meat and milk, and have been accompanied by a careful record of the quantities and market value of the products, and by numerous analyses of the sewage before and after irrigation, as also of the grass and of the milk. The general conclusions are summed up as follows:—1. The right way to dispose of town sewage is to apply it continuously to land, and it is only by such application that the pollution of rivers can be avoided. 2. The financial results of a continuous application of sewage to land differ under different local circumstances; first, because in some places irrigation can be effected by gravity, while in other places more or less pumping must be employed; secondly, because heavy toils (which in given localities may alone be available for the purpose) are less fit than light soils for continuous irrigation by sewage. 3. Where local circumstances are favourable, and undue expenditure is avoided, towns may derive profit, more or less considerable, from applying their sewage in agriculture. Under opposite circumstances, there may not be a balance of profit; but even in such cases a rate in aid, required to cover any loss, need not be of a large amount. On the basis of the above conclusions, the Commissioners submit that the following two principles are established for legislative application:— First, that wherever rivers are polluted by a discharge of town sewage into them, the towns may reasonably be required to desist from causing that public nuisance. Second, that where town populations are injured or endangered in health by a retention of cesspool matter among them, the towns may reasonably be required to provide a system of sewers for its removal. And should the law, as it stands, be found insufficient to enable towns to take land for sewage application, it would, in the opinion of the Commission, be expedient that the legislature should give them powers for that purpose.

ON THE ACTION OF SEA WATER UPON CERTAIN METALS AND ALLOYS.

By F. Crace Calvert, Ph.D., F.R.S., F.C.S., &c., and Richard Johnson, F.C.S.

We were induced to examine the action exerted by sea water, in consequence of the rapid changes which have taken place of late years in naval architecture, and especially in the substitution of metals and alloys for wood, and because one of us is largely engaged in the manufacture of wire for submarine and other telegraphs, and, when spun into ropes, for ships' rigging.

To carry out the above views, we took 20 square centimetres of each metal, which we cleaned with great care and attention, in order that the action of the sea water might have its full effect; then two plates of each metal were placed in separate glass vessels, and immersed in equal volumes of sea water. After one month the plates were taken out, and any compounds that had adhered to the surface carefully removed; the plates were then dried and re-weighed, and the loss estimated. To render our results of more practical value, we have calculated the action of 100 litres of sea water upon one square metre of each metal, and the following are the amounts of metal dissolved:—

	Grammes.
Steel	29·16
Iron	27·37
Copper (best selected)	12·96
Copper (rough cake)	13·85
Zinc	5·66
Galvanised Iron (Johnson's process)	1·12
Block Tin	1·45
Stream Tin	1·45
Lead (virgin)	Trace
,, (common)	Trace

These results lead to the following conclusions:—

1. That steel is the metal which suffers most from the action of sea water.

2. That iron is most materially preserved from the action of sea water when coated with zinc, and, therefore, not only should iron exposed to the action of sea water be galvanised whenever this is practicable, but, in our opinion, it would amply repay shipbuilders to use galvanised iron as a substitute for that metal itself.

The above facts perfectly confirm those which we have already published in our paper, "On Galvanised Iron for Armour Plated Ships," in which it was shown, that when iron was in contact with oak they mutually acted upon each other, producing a rapid destruction of the two materials, whilst little or no action took place between galvanised iron and the wood.

3. The extraordinary resistance which lead offers to the action of sea water, naturally suggests its use as a preservative to iron vessels against the destructive action of that element; and although we are aware that pure lead is too soft to withstand the wear and tear which ships' bottoms are subjected to, still we think that an alloy of lead could be produced which would meet the requirements of shipbuilders.

Feeling that experiments made with a limited amount of sea water might not be a fair criterion of the action of the ocean upon metals, we repeated our experiments upon plates of 40 centimetres square, which were immersed for one month in the sea on the western coast (Fleetwood), taking the precaution that they should be constantly beneath the surface of the water, and suspended by flax rope attached to a wooden structure, to prevent any galvanic action taking place between the plates and the structure to which they were attached.

The following are the amounts of metals dissolved:—

	Grammes.
Steel	105·31
Iron	99·30
Copper (best selected)	29·72
Zinc	34·34
Galvanised Iron (Johnson's process)	14·42
Lead (virgin)	25·69
,, (common)	25·85

The foregoing figures suggest the following remarks:—

That the action has been much more intense, in this instance, than when the metals were placed in a limited amount of water at the laboratory. These results are due probably to several causes acting at the same time, viz.:—that the metal was exposed to the constantly renewing surface of an active agent; and that there was also a considerable friction exerted on the surface of the plate by the constant motion of the water, there being at Fleetwood a powerful tide and rough seas. What substantiates this opinion is, that the lead plates undoubtedly lost the greater part of the weight, not by the solvent action of the sea water, but from particles of lead detached from them, in consequence of their coming in contact with sand and the wooden supports to which they were attached; but this cause of destruction having been observed with lead plates, it was afterwards carefully guarded against in the case of all the other metal plates.

We also deemed it desirable to examine the action of sea water on various brasses. We therefore immersed for one month plates of various alloys in that fluid, and proceeded to record our results:—

Action of 200 Litres of Sea Water upon One Square Metre Surface of the following Brasses:

Composition of the Brasses.		Quantity of Metals Dissolved.			
		Iron.	Copper.	Zinc.	Total.
Pure Copper	50				
Pure Zinc	50				
	100	—	1·110	10·537	11·647
Commercial Brass:					
Copper	66·				
Zinc	32·5				
Iron and Lead	1·5				
	100	0·579	3·667	3·324	7·570
Muntz Metal (Sheet):					
Copper	70·				
Zinc	29·2				
Iron and Lead	0·8				
	100·0	0·438	4·226	2·721	7·385
Muntz Metal (Bars):					
Copper	62				
Zinc	37				
Lead and Iron	1				
	100·0	0·501	2·697	3·493	6·691
Prepared Brass:					
Copper	50				
Zinc	48				
Tin...............	2	Tin.			
	100	0·365	7·04	3·477	10·882

The above table shows how very differently sea water acts upon divers brasses and the influence exercised upon the copper and the zinc composing them, by the existence in them of a very small proportion of another metal; thus, in pure brass the zinc is most rapidly dissolved (which, *en passant*, is the contrary to what takes place in galvanised iron), whilst it acts as a preservative to the copper.

Tin, on the other hand, appears to preserve the zinc, but to assist the action of sea water upon the copper.

The great difference between the action of sea water upon pure copper and upon Muntz metal seems to us to be due not only to the fact that copper is alloyed to zinc, but to the small proportion of lead and iron which that alloy contains; and there can be no doubt that ship-builders derive great benefit by using it for the keels of their vessels.

We were so surprised at the inaction of sea water upon lead that we were induced to compare its action with that of several distinct varieties of water, viz., Manchester Corporation water—well water—distilled water in contact with air—the same deprived of air—and the following are the amounts of metals dissolved by 200 litres of these waters upon one square metre of surface during eight weeks:—

	Grammes.
Manchester Corporation water............	2·094
Well water......................................	1·477
Distilled water (with air)..................	110·003
,, ,, (without air)	1·829
Sea water	0·038

These figures require no comment, as they confirm our previous result that sea water has no action on lead, except what arises from friction.

Fine Arts.

The Pourtales Sale.—This great sale, which commenced on the 6th of February, and occupied twenty-nine actual sale days, closed on the 4th instant. The interest created, and the prices obtained, have been enormous. The collection has remained unsold, in accordance with the will of the deceased Count de Pourtalès-Gorgier, for ten years since his death, and there is little doubt that this circumstance has enhanced the receipts by something like 50 per cent. The estimates of the experts, who in Paris fix an upset price at the auction, have been very generally surpassed, and the total amount of the sale falls little short of £150,000. The late Count bought carefully, and at a time when objects of art were low in price in France, and it is believed that the collection has sold for at least five or six times more than it cost. The following are amongst the most interesting of the three thousand and odd items:—*Pictures.*—Albertinelli, Holy Family, sold for a sum equal to £500. Antonello de Messine, pupil of Van Eyck, from whom he learned the art of painting in oil, Portrait of a Man, bearing date 1475, and being the only known work of this artist, purchased for the Louvre at £4,540. Giovanni Bellini, pupil of the preceding, Holy Family, £824. Angiolo Allori, called Il Bronzino, Portrait of a member of the Medici Family, £2,200. Carlo Dolci, Saint Catherine, £1,080; and Christ in Purgatory, bearing a standard, and giving his hand to Saint Thomas to kiss, picture that decorated the sacristy of a Florentine convent, £728. Francia, Madonna and Child, St. John and an Angel, £860; and a Holy Family, £560. Leonardo da Vinci, Madonna and Child, £3,340. Moroni (who died in 1578), Portrait of a bearded Man, £504. Palme the Elder, Holy Family, £408. Sebastian del Piombo, Portrait (supposed) of a Duc d'Urbin, £3,720. Paul Veronese, Portrait of his Daughter, £820. Philippe de Champaigne, Marriage of the Virgin, formerly the altar-piece of the Chapel of the Palais Royal, in Paris, a long picture, containing about twenty figures, purchased by the Marquis of Hertford for £1,740; Portrait of his Daughter, a Nun of Port Royal, £884. Francis Hals, Portrait of an Officer, also purchased by the same nobleman for £2,040. Rembrandt, Portrait of a Burgomaster, lately in the collection of Mr. Farrer, of London, £1,380; and Portrait of a Warrior, £1,080—two magnificent works purchased for the National Gallery of London. Rubens, beautiful small Portrait of a Noble, bought for the Louvre, £440. Murillo, The Triumph of the Eucharist, a large mystical composition, with many figures, also purchased for the Louvre, £2,700; a Madonna and Child, £720; and Saint Joseph walking with the Infant Jesus, £600. Velasquez, a Young

Warrior, wearing a black cuirass, lying dead in a cavern, known as the "Dead Roland"—a noble work, bought for the National Gallery, at £1,400. Bonnington, the Sea Coast at Low Water, £260. Boucher, a Poor Artist Working in his Garret, amid signs of poverty and confusion, £280. David, Portraits of Pius VII. and Cardinal Caprara, £712. Decamps, a Soldier of the Sultan's Guard, a very small but beautiful work, £320. Delaroche, Saint Cecilia, £840; Cardinal Richelieu, in his Barge on the Rhone, leading Cinq-Mars and De Thou to Execution; and its companion picture, Cardinal Mazarin on his Death-bed, the Court playing cards near it, and one of his nieces showing him her hand, sold together for £3,200; and the Temptation of Saint Anthony, £408. Greuze, Innocence, a young girl with a lamb in her arms, £4,008; and Portrait of a Young Girl, a small work, £208. Ingres, Raphael and the Fornarina, £380. Lancret, Women Bathing, £292. Lenain, a French artist, who died in 1648, Six Nobles of the time of Louis XIII. sitting round a table talking and smoking, £700. Claude Lorraine, Italian landscape, Sunrise, from the collection of Mr. William Smith, of London, £1,460. Meissonnier and Francas, figures by the former in a landscape by the latter, £500. Rosa Bonheur, Shepherd guarding sheep and goats, £364. Ary Scheffer, Young Mother, £260. Horace Vernet, Thamar and Inda, £1,408. *Drawings and Sketches.*—A sketch of the Adoration of the Shepherds, by Pinturicchio, called "Il Bernardino di Benedetto," a painter of the Ombrian school, who died in 1513, £200. Pen-and-ink drawing, by Albert Durer, in three parts, bearing date 1510, £180. Crayon drawing, by Prudhon—Helen and Paris reconciled by Venus—£196. *Antiquities.*—The celebrated vase in Oriental red porphyry, from the villa Albani, and known as the Vase of Pallas, £680. Colossal statue in marble of the Emperor Augustus, formerly in the possession of Cardinal Richelieu, purchased for the Berlin Gallery, at the price of £1,048. Statue of Cupid bending his Bow, an antique copy of a work supposed to be by Praxiteles, and of which a similar copy is to be seen in the British Museum, £340. Young Satyr and Panther, Greek, £612. Colossal head, called of Apollo, formerly in the Giustiniani Gallery, and one of the purest specimens of Greek art, purchased for the British Museum at £1,800. The painted Greek vases in this collection were, perhaps, on the whole, unrivalled. One of these, decorated with subjects belonging to the Eleusinian mysteries, fetched £100; and another, with episodes from the story of Theseus and Hippolyta, £404. *Antique Bronzes.*—Small statuette of Jupiter, found at Besançon, £320. Another of the same personage, seated, found in Hungary, £480. A diminutive figure of Apollo, but very celebrated on account of its antiquity, an inscription upon it carrying it back to the sixth century before the Christian era, £200. Small statuette of Minerva, in the finest style of Greek art, £768. Four pieces of armour, a casque, grieves, arm pieces, and buckler, found at Herculaneum, bought by Prince Napoleonfor £520. Small bust of a Roman, unknown, celebrated by Visconti, purchased for the Louvre at £182. Elegant tripod from the ruins of Mataponte, Berlin Gallery, £400. Large ornamental seat in bronze, from Rome, Louvre, £212. Fine bronze vase, from Locris, £280. Another, found in one of the tombs at Vulci, £360. Candelabrum, found with the same, £80. Lampadaire, a bronze pilaster with arms, supporting four small lamps of different forms, from Herculaneum, purchased for the Louvre at £116. *Terra Cotta.*—This portion of the collection contained some very remarkable examples. A small coloured statuette of a woman seated crossed-legged and arranging her hair, found in Athens, fetched the extraordinary sum of £100. Two small fragments of a bas-relief, £86.—A fine Greek cameo, with a single female figure, went for £108; a series of thirty intaglios in rock-crystal, by Valerio Belli, £520; and an ancient glass vase, found near Amiens, £84.—The *sculpture in ivory* was remarkably choice. A statuette of Hercules, supposed to be the work of John of Bologna, sold for £656; a small statuette of Venus, by F. Flamand, £236; a tankard, by the same, purchased by M. Thiers for £524; a circular bas-relief, with six figures of children, £284; another, Pan with a group of children, £212; portraits of Jacob Herbrot and Marina Krater, his wife, carved in wood, and bearing the date 1527, attributed to Albert Durer, fetched £240; and a medallion, also in wood, with the head of Ludovicus Dangerant, and the date 1529, £36. A bronze bust of Charles IX. of France, life-size, the work of the period, formerly in the collection of the Duc de Berry, sold for £1,800. *Porcelain and Faïence.*—This section presented instances as extraordinary as any of the others; a large *coupe* or tazza of Gubbio ware, sold for £136, and a round dish of the same for a like sum. A large dish of faïence d'Urbino, £65; and a vase of the same, £148; a small square of Faenza ware, with a subject after Albert Durer, £126; a large oval dish, by Bernard Palissy, £112; and a grand salt-cellar by the same, £202. But the gem of this portion of the sale was a vase of the so-called Henry II. ware, which was purchased by a private gentleman, M. Van Cuych, for £1,100.—The *Limoges* and other enamels were extremely fine and numerous. A beautiful covered cup, presented to Mary Stuart when she was affianced to Francis II., fetched £1,084; a round basin, *grisaille* enamel, £808; a large dish-tray in exquisite coloured enamels, subject, "The Egyptian Army Drowned in the Red Sea," by Jean Courtois (or Courteis), £1,200; a small ewer to match, £280; and an oval plateau by the same, *grisaille*, £560; a *coupe*, or large flat glass, of Venetian manufacture, of the fifteenth century, fetched £100; a vase in rock-crystal, a fine work of the sixteenth century, £460; three others, £200, £284, and £352 respectively; a jasper cup, £576; a knife and spoon in silver gilt, supposed to be the work of Benvenuto Cellini, £442; and, more wonderful than all, a pewter ewer and basin, ornamented with arabesques and medallions by François Briot, with his own portrait beneath the basin, was bought for £300. This rapid sketch of a few of the gems will give some idea of what was the Pourtalès collection, which the hammer of the auctioneer has now scattered over the face of the globe.

Photography on Painting Canvas.—Many attempts have been made to obtain a photographic groundwork for oil paintings, but heretofore without much success; it is said, however, that the Belgians have been more successful than their neighbours. The method adopted is, to use fine canvas, or silk, such as is employed for small and delicate works, simply to cover the surface with a preparation of collodion and chloride of silver, and to expose it and fix it in the ordinary manner just as in the case of paper. It is said that no difficulty whatever arises, provided that the collodion be well selected; if of a nature to dry hard and horny, it will fall from the canvas, and so spoil the work, but if it sets in a smooth, even manner, it can only be removed from the canvas by means of a solvent.

Shakespeare Illustrated by Dore.—It is said in Paris that M. Gustave Doré, who has already exercised his fertile and picturesque pencil on Dante, Chateaubriand, and Cervantes, is engaged in a series of illustrations of the works of Shakespeare. There is no doubt that M. Doré will find an immense number of passages suitable to his genius, but it is to be hoped, for his own reputation, out of France especially, that he will pay some attention to local characteristics and colouring, and avoid such incongruities as are exhibited in his illustrations of "Atala," in which we find northern firs and tropical palms most unfortunately mingled—though, it is just possible that, in this case, the author and the illustrator may deserve equal blame; and also, that he will attempt to endow the personages of Shakespeare, and more especially the female characters, with general, nay, universal, physiognomical characteristics, avoiding the conventionality which marks so terribly the otherwise admirable delineations of many of his own countrymen.

Manufactures.

Cast-Lead Traps.—Hitherto stink traps have been made by hand, whether of the S form or otherwise, it not having been found practicable until now to cast them, loam cores being too expensive. They were formed by beating up the lead and joining the parts by solder, a process involving time and labour, and therefore expensive, whilst at the same time the roughnesses and corners left in the soldering rendered the article more liable to collect dirt and clog. Messrs. Beard and Dent are now employing an invention of Mr. Lowe, an American, who uses cores of gun-metal or cast-steel, composed of several pieces readily put together and easily withdrawn after the casting is made. Under the old system four traps only could be made in a day by a plumber and a labourer, whilst by the new plan, with two sets of corners, four men can make eighteen such traps in one hour. The advantages are :—1. That the traps are considerably cheaper than hand-made traps. 2. That they are of pure and solid lead, without solder or seam of any kind, and as smooth and clear inside and out as pipe made by hydraulic pressure. 3. That they are of perfect regular substance throughout; and, being composed of one metal, are not subject to injurious expansion from hot water, nor are they liable to be affected by the generation of gases, which almost invariably destroy the ordinary trap.

Cologne International Exhibition.—It has been already announced in these columns that the Cologne Exhibition has been deferred to the 2nd June, in order to give foreign exhibitors the benefit of the conditions of the new tariff, but it is not generally known that the scope of the exhibition is limited to certain classes of objects. The whole is to be classed under four heads :—I. Agriculture. II. Domestic Economy. III. Matters relating to Forest Life and the Chase. IV. Horticulture. These denominations must, however, be taken in the widest sense. In the first place, agriculture includes all matters connected with wine, sugar, distillation, &c.; domestic economy—materials and articles of clothing of all kinds, as well as furniture, glass, and other household necessaries—while vehicles of all kinds will come under the various classes. The management exhibits a determination to make the undertaking successful. There is no charge for space; the railways of France, Belgium, and the Rhenish provinces have announced a reduction of one-half on the tariff for the conveyance of goods to be exhibited, and the charge for conveyance to or from the terminus to the Exhibition is fixed at 50 centimes per 50 kilogrammes (5d. per cwt.), customs declarations and other formalities included; and no duty will be charged unless the machinery or goods are sold. Moreover, in order to aid the sale of the objects exhibited the commission has devoted the sum of 40,000 francs for the purchase of articles which will afterwards be disposed of by means of a lottery. Medals are to be given in all the classes, and three important prizes, in money, the amount of which, however, is not yet made known, for the best steam plough, the best fire pump, and the best locomotive for common roads, respectively.

New kind of Mirror.—The Paris correspondent of the *Chemical News* writes that M. Dode, a provincial chemist, has introduced platinum mirrors, which are greatly ad-admired, and which present this advantage, that the reflecting metal is deposited on the outer surface of the glass, and thus any defect in the latter is concealed. The process, which is patented here, is described as follows:—Chloride of platinum is first made by dissolving the metal in aqua regia, and driving off the excess of acid. The neutral chloride is then dissolved in water, and a certain quantity of oil of lavender is added to the solution. The platinum immediately leaves the aqueous solution and passes to the oil, which holds it in suspension in a finely-divided state. To the oil so charged the inventor adds litharge and borate of lead, and he paints a thin coat of this mixture over the surface of the glass, which is then carried to a proper furnace. At a red heat the litharge and borate of lead are fused and cause the adhesion of the platinum to the softened glass. The process is very expeditious. A single baking, M. Dode states, will furnish 200 metres of glass ready for commerce. It would take fifteen days, he says, to coat the same extent with mercury by the ordinary plan. A considerable reduction in the cost of looking-glass is expected from the adoption of this process; for any glass, even the common bottle metal, will serve to be coated.

Aniline Black Dye.—French manufacturing chemists and dyers have of late given great attention to the production of a black dye from the aniline source, and M. Charles Lauth has invented a new process, and his black aniline dye has been used at Mulhouse for printing from 15,000 to 20,000 pieces of muslin. The system employed by M. Lauth is to print with matter insoluble in water and acids, but which becomes soluble afterwards on the fabric. In his own words the process is thus described:—"My receipt for black aniline dye consists in printing with chlorate of potash and aniline salt on a preparation of soluble iron or copper, but I give the preference to sulphite of copper. The printed stuff is then exposed to oxidation and afterwards washed, when the black is perfectly fixed." The acid of the aniline salt decomposes the chlorate of potash; the chlorine, or its oxides, transforms the copper into sulphate of copper; and the last-named product aids in the oxidizing process. The advantages claimed for M. Lauth's process are as follows:—The sulphite of copper, being entirely insoluble, has no effect on the roller and scrapers; the colour in its soluble state containing nothing but chlorate of potash and an aniline salt, will remain unchanged for a long period; it is cheap, costing only about 90 centimes a litre (4s. 9d. per gallon English); it fixes easily in a temperature of 20° centigrade (less than 69° Fahrenheit); it may be applied to almost all kinds of work, and, when proper precautions are taken, has no injurious effect whatever on the tissue. The aniline black of M. Lauth is declared to resist not only ordinary but chemical agents, and so to incorporate itself with the fibres of the printed fabric that nothing can afterwards move it.

Commerce.

Tea in Hill Tipperah.—The tea tree has been found in Hill Tipperah by Mr. Civil Assistant W. C. Rossenrode, whilst carrying on the approximate triangulation in advance last season, at a hill called Sabrong, in lat. 23 deg. 2 min. and lon. 91 deg. 48 min. There is another tree in this country, called, in Bengal, the "maritcha," growing up to twenty-five or thirty feet in height, the venation of the leaves of which is the same as that of the tea. The tea tree will grow and thrive wherever the maritcha is found. The clove plant has always been found indigenous on the table-land between Gojalia and Tulamara. Dr. Cleghorn pronounces it a *cinnamonum*. Now that tea is known to thrive in Chittagong and Tipperah, the *Friend of India* sees no reason why, in time, the whole of the low hill ranges which lie between Assam, Burmah, and south-western China, should not be cultivated.

Oil from Tea Seed.—It has lately (says the *Englishman*) been an important question among tea-planters, what to do with the large quantity of tea seed now available. It will, therefore, be an interesting fact for them to learn that a trial was recently made at Calcutta to produce oil from tea-seed. The result would seem to prove that three maunds of tea-seed will yield about one maund of oil. The oil is very similar in appearance to olive-oil. The *modus operandi* is very simple. The seed is first crushed in a crushing machine, and then pressed in another worked horizontally by an Archimedean screw.

Tea in India.—The *Calcutta Englishman* says:—Perhaps the most interesting feature of the current history of Bengal is the progress in outlying and hitherto uncultivated tracts of country. Foremost among such tracts are Sylhet, Cachar, and Assam. In Sylhet the progress last year has been great beyond all precedent. The first tea garden was laid out in 1857, but English enterprise did not take root in the province till 1860, when the first of the existing plantations was started. In 1862 more than 1,000 acres were already under cultivation, and in 1863 the number had increased, in round numbers, to 2,500. In 1863 the yield was 31,200 lbs. of tea and 526 maunds of seeds, and last year these numbers have suddenly risen to 81,200 lbs. of tea and nearly 1,500 maunds of seed. This increase is made in spite of the greatest scarcity of labour, nearly one-third of the coolies being imported. In this province at least the government seems satisfied that the coolies have no serious grievance to complain of. The labourers are allowed extra remuneration for doing more than their allotted task, and their average earnings, according to the report, amount to five rupees a month each cooly. The wages of such men in a Bengal district do not exceed seven pice a day, or something less than three rupees, counting six days to the week. Applications for 75,000 acres await disposal by the collector. In Cachar the cultivation is on a larger scale. Some of the plantations have been in operation for seven years, and cultivation is in progress in 110 estates, aggregating more than 250,000 acres. At the end of 1863 the capital expended was close on 40 lacs, producing a return of 418,243 lbs. of tea and 1,019 maunds of seed; but during the past year the yield has more than doubled, and the estimated turn-out is 823,380 lbs. of tea with 2,573 maunds of seed. The difficulty in procuring labour is even greater in Cachar than in Sylhet. In the latter nearly one-third is imported, in the former the proportion is fully three-quarters. In Assam nearly 200,000 acres have been taken up, affording employment to 28,000 labourers, and sending about £300,000 worth of tea to England, besides what is consumed in India. From Darjeeling no precise information appears to have been obtained for the year 1864, but the purchasing of estates is going on rapidly. The out-turn during 1863 was close on £100,000. The Ramgurh Tea Company have more than doubled their land under cultivation last year in Chota Nagpore; another company is busy in a range of hills to the south-east of Hazareebaugh, and tea-planting in central India is now a *fait accompli.* The young plantations are said to be vigorous and healthy, and the very large proportion of seed that has germinated proves, more conclusively than any geological report, that the soil is well adapted for tea. Labour is cheap, abundant, and to be found on the spot. Taking this into consideration, Col. Dalton observes that, even if the leaf-producing powers of the plant were only half as great in Central India as in Assam and Cachar, the profits of plantations would be equally good. In Chittagong, too, the soil is reported well adapted for tea and coffee cultivation. During the past financial year several tea planters visited the district and applied for grants. Some difficulty is anticipated in making new allotments, "owing to the rather loose and hap-hazard way in which large tracts of land were, so to speak, given away rent-free for long periods at the settlement of the district." It will be remembered that a sample of Chittagong tea won a medal in the Agricultural Exhibition at Alipore. A small estate has been in cultivation for many years near the Sudder station, and a considerable number of acres has recently been broken up for the plant in the hill tracts. We have not space to-day to enter more fully into the report. The figures given in it are under the truth rather than over it, and they refer only to a single branch of English enterprise in India. We find that in one province this portion of British enterprise has trebled itself during the past official year, and in another has doubled itself. The returns of only two tea-growing districts are given in full, but we believe that the same proportion holds good in all. This single branch, tea-planting, has changed the destiny of whole provinces greater in area than England, and turned vast tracts of unhealthy, unprofitable wastes into revenue-paying and life-supporting land. It has belted our North-Eastern frontier with a ring of gardens, and placed an advance guard of Englishmen between the plains and the hill tribes. But this is not all. It has furnished an accessible and profitable vent for the over-crowded population in Bengal proper, and done much to ameliorate the condition of the labouring classes throughout the whole country.

Colonies.

Manufactures of New South Wales.—There are 180 mills for grinding and dressing-grain. Of these, 129 are steam mills, 20 are driven by water, 13 are windmills, and 18 are worked by horse-power. Thirty-three of these mills are in the pastoral districts. In the year 1860 the number of mills was 193, since which date the number has continuously declined. The number of establishments or machines which are classed under the head of manufactories or works in the old settled districts is 1,568, of which only 323 are in Sydney, and in the pastoral districts 1,768. But under this heading is included the following miscellaneous assortment. Connected with agriculture:—Tobacco factories, steam bakeries, reaping and threshing machines, chaff-cutters, bone crushers. Connected with the pastoral interest:—Soap and candle works, cloth factories, tanneries, fellmongering, meat preserving, boiling down, wool washing, steam wool pressing. Connected with articles of food and drink:—Distilleries and sugar refineries, rectifying and compounding establishments, breweries, steam coffee mills. Connected with building:—Potteries, brick-making, lime-kilns, and saw-mills. Connected with metals:—Millwrights, iron and brass foundries, type foundries, engineering works. Miscellaneous:—Quartz-crushing machines, stone crushing machines, hat manufactories, rope walks, salt works, dye works, gas works, anchor works, steam slips, patent slips, dry docks, fire engines, steam engines, railways, bark cutters, ice manufactories, steam printing presses, water works, gold-washing machines and ship-building yards. This colony appears to be behind some of the neighbouring colonies in respect of improved agricultural implements, three or four of them having imported steam ploughs. The woollen manufacture in 1863, was only to the extent of 64,650 yards, which was only half that of the preceding year. The manufacture of soap was also below that of the preceding year, though the number of establishments had slightly increased. The manufacture of candles was to the extent of 17,237 cwt. There are thirty-nine boiling-down establishments in the colony, of which ten are in the pastoral districts. At these places there were slaughtered 7,574 sheep and 30,335 head of horned cattle, from which were produced 57,594 cwt. tallow. This was an increased production over the previous year. During each of these two years about a quarter of a million sheep were slaughtered, "But," says a Sydney paper, "sheep are too valuable now to be boiled down. The necessity for stocking all new runs has created a great demand, and everything that can crawl on four legs has a value. But if the multiplication of stock continue at its present rate, and especially if the price of wool should decline, the sheep will find their way again in larger numbers to the boiling pot."

New Zealand Industrial Exhibition.—This exhibition was opened at Dunedin on the 12th January. The Governor was not present, and his honour the Superintendent filled his place. The exhibition is stated, considering all circumstances, to be a marvel of success. The natural products and manufactures of the colony are well represented, and the collection affords striking

proofs of the great resources of New Zealand. Owing to the unfortunate detention of the *Ramsay*, in which ship are the Indian and British exhibits, the exhibition is deprived of one of its chief attractions. The obelisk representing the bulk of gold got in Otago is the most prominent object; and opposite it stands the elaborate and beautiful apparatus for the lantern of the Cape Saunders lighthouse. The displays of gold and jewellery, in several cases, attracted much admiration. At the northern end of the hall, in the dividing line between Otago and England, stands the dais which was intended for the governor. At the other end of the hall stands the Wellington-built organ, contributed by Mr. Lewis; and in front of the organ was an orchestra for fifty members of the Philharmonic Society. A line of flags, festooned near the ceiling, extended the length of the building. Above the entrance there was hung a very large piece of carpet-work, the centre of which represents Napoleon III. presenting to Queen Victoria a document bearing the words, "The Treaty of Commerce—a further proof of our friendship." At several points, rich carpeting and other specimens of manufacture were displayed in front of the gallery; and a broad band of crimson cloth stretched round the building, just below the line of the glass forming part of the central roof. The interior of the building is said to have a light appearance, despite the absence of chromatic colouring on the walls and ceiling. In the address of the Royal Commissioners to the Superintendent, they describe the objects of the exhibition as being, "to collect together some of the evidences of the remarkable progress of the colony, which attest the energy of its inhabitants; to place them side by side with the products of other colonies and the parent country; to afford the opportunity of comparing the raw material of the newly occupied country with the finished manufactures of the old; to gratify successful enterprise by an acknowledgment of its merits; and to encourage further exertion by the approval of what has been already done." They go on to say, "that but for the unhappy differences which have for so long time past severed the two great sections of the American Union, very considerable additions from those States would have been made to the collection. The Province of Otago recognises with sentiments of the deepest gratitude the zeal and liberality which have marked the co-operation of other provinces and contributors, but we desire to mention the fact that the building in which the exhibition is contained, has been erected at the sole cost of this province." They draw particular attention "to the collections illustrative of the geology of the colony, both on account of their extent and of the intrinsic value of such collections in their bearing on the development of the resources of a country from the mineral wealth of which so much has already been derived, and so much may be confidently expected." They also contrast with these more material evidences of their resources, the proof of social and intellectual refinement which is to be found in the exhibition of fine arts, one which they believe will be admitted to be extremely creditable to the taste and practical skill in art of so young a colony. His honour the Superintendent, in his reply, addressing the Commissioners, said:—"You have been engaged in a noble as well as an arduous work, and you will receive the reward of your self-sacrificing labours in the knowledge that through their means New Zealand has become entitled to claim a higher place than has yet been allotted to it amongst the colonies of Great Britain. The beneficial effects of this exhibition on the colony may not be immediately appreciable, but you have sown good seed in a fertile soil, and may confidently look for an abundant harvest. Through this exhibition New Zealand will be brought out from its obscurity into a face-to-face meeting with the outer world. Many of its great and varied resources will be exemplified—its vitality and progressive character will be attested, new industries will be created, existing ones revived, public taste and morals will be elevated, and a generous emulation between various provinces and colonies will be promoted."

Obituary.

Auguste Hyacinthe Debay.—France has lost a very able artist by the death of this gentleman, which happened a few days since. M. Debay was both painter and sculptor; three of his pictures are at Versailles, "The Enrolment of the Volunteers in 1792," "The Meeting of Henry the Eighth and Francis the First on the Field of the Cloth of Gold," and "The Battle of Dreux." There is one in the Luxembourg gallery, subject from the story of Lucretia. He also executed, amongst other works, the monument to the memory of the late Archbishop Affre, and a statue of Perrault for the new Louvre. His most celebrated work, however, and certainly that by which he will be most generally remembered in England, is "The First Cradle, Eve with Cain and Abel in her lap," a beautiful marble group, which attracted great attention at the Great Exhibition of 1851. M. Debay obtained the very rare honour of first-class medals, both for painting and sculpture, at the Paris Fine Art Exhibitions, the former in 1831 and the latter in 1855. He was only in his sixty-first year when he died.

Publications Issued.

Traité des Brevets d'Invention. By Augustin Charles Renouard. 8vo. (*Guillaumin and Cie.*, Paris.)—At present, when the law of patents is under consideration, it is necessary to know what are the opinions of enlightened foreigners with respect to this much vexed question, and what results of the patent system have been noted in other countries besides our own. M. Renouard is a Counsellor of the Court of Cassation in Paris, and a member of the French Institute, and in every way he has a strong claim on the attention of both the friends and opponents of the patent system. The work, of which the title is quoted above, is the third edition, augmented and materially altered, of a treatise first published so long ago as 1825, and which has always enjoyed a high reputation. M. Renouard has also published other important works on the rights of authors and artists, and on the principles of civil, commercial, and international rights. The work in question is divided into three parts; the first treating of the theory of legislation with respect to inventions, and of its history in France and in each of the other principal states in the civilised world; the second, detailing and explaining the practice of the law in France; and the third being a collection of the Acts passed in France on the subject, from 1844 to the present time. M. Renouard is a warm supporter of the right of the inventor to protection. He says:—"Respect for the rights acquired by labour is one of the fundamental principles of social order. It would be a fatal error to isolate this from that which is due to property." As regards the mode of exercising that right, and conciliating it with those of the public, M. Renouard says:—"The duty towards society is to prevent the public from losing the invention, which, by the very act of publication, enters into the domain of the public mind." . . . . "The legislation problem consists in finding the proper mode of payment." He discusses the proposed system of public recompense, and that of fixed fees for licences, but rejects them both in favour of the principles which form the foundation of the patent laws of all countries; and he declares it to be his profound conviction that the objections raised against the present law are, when examined in a philosophic spirit, of very little weight when placed in the scale against the rights of the inventor. Those who differ from M. Renouard as respects his conclusions, will find a vast amount of historical matter of great interest in his work, especially in the chapters referring to the ancient Industrial Corporations in France, and to the regulations and privileges appertaining to manufactures and to the condition of the inventor previous to 1791.

Manual of the Turkish Bath: Heat a Mode of Cure and a Source of Strength for Men and Animals.—Edited by Sir John Fife M.D., senior surgeon to the Newcastle Infirmary. (*John Churchill and Sons.*)—This work contains views and opinions taken from the writings and sayings of both medical and non-medical men in reference to the efficacy of the bath. The editor, in his preface, says, "in the year 1859, having previously satisfied my own mind of the efficacy of this process, I brought it under the consideration of the Pathological Society of Newcastle, and afterwards addressed on the subject the House Committee of the Newcastle Infirmary, who, encouraged by his Grace the Duke of Northumberland, well experienced during his eastern travels in the value of the Turkish bath, entered energetically into the enterprise of constructing such baths for the hospital. The effect of this wise measure has been essentially economical, inasmuch as by shortening considerably the necessary period of confinement within the walls of the hospital, less expense has been incurred in restoring many hundreds of working men to their habits of useful industry. Great must be the value of a process which, in a few minutes, will secure a general diaphoresis, bring the circulation to the extremities, and equalize the arterial action instead of permitting a disordered influence to direct an undue flow upon one tortured part to the comparative deprivation of arterial blood to other and distant structures; a process competent to allay spasm immediately in many cases which might resist all other diaphoretics, or exhibit their effects only in gastric and intestinal irritation." The work is divided into two parts; Part I. treats of the action of the bath on man, and commences with a dialogue, in which Messrs. Erasmus Wilson, Witt, and Urquhart took part, and in which the question of "Heat, how useful to man and how used by him," was discussed; written from short-hand notes. This is followed by a second dialogue, being a conversation between Mr. Urquhart and the members of the London Medical Society at Rickmansworth. Next comes a paper read by Mr. Urquhart before the Society of Arts, "On the Art of Constructing the Turkish Bath;" then a lecture by Mr. Urquhart, "Why Does Man Perspire?" and articles under the following heads:—"Consumption Produced by Habits, not Climate;" "Treatment of Consumption by the Turkish Bath," by Dr. Leared, &c.; with papers referring to the treatment of cancer, leprosy, hydrophobia, and apoplexy; cure of cataract; the construction of a bath with radiating heat for invalids, comprised in a correspondence with Sir John Fife, "The introduction of the bath into lunatic asylums and naval and military hospitals, with Dr. Robertson's experience at the Sussex Lunatic Asylum," and a paper on "Heat rays, sun rays, electricity and vital power," concludes Part I. To all these papers a large amount of notes is added. Part II. relates to the action of the bath as regards animals, and consists of two papers, one entitled "The Bath in the Farm," which refers to the training of horses, the treatment of domestic animals, and Admiral de Rous's views "On the Bath for Horses;" and the other called "Four Years' Experience of the Bath on an Irish Farm," by J. E. Scriven, Esq. An appendix concludes the work. There is a vast deal of useful information connected with the bath to be found in this small volume, and much that is worthy of impartial consideration. In statements by non-professional persons, it is necessary, says the editor "to guard against hasty conclusions on the one hand; or, on the other hand, the rejection of statements that may seem at variance with the therapeutic science of men experienced in the value and justly confident in the indications which therapeutics afford."

L'Ancienne Academie des Sciences. By Monsieur L. F. Alfred Maury. 8vo. (*Didier and Co.*, Paris.) This is a companion volume to one by the same author, M. Maury, of the French Institute, Professor of History and Morals at the College of France, on the Academy of Inscriptions and Belles-Lettres. Like the latter, this gives a detailed history of the rise and progress of the academy of which it treats, but, in a practical point of view, it is of far greater importance, for it presents also a history of the march of science itself, while the Academy of Belles-Lettres could not furnish any array of positive facts for such a history of subjects. M. Maury says, and with justice, that didactic treatises seldom afford sufficient information upon the various steps which have been taken in science, and of the successes and failures which have alternated with each other; and thus the man of science, and more especially the student, is not furnished with those data which might prevent his falling into the very errors which his predecessors have discovered and often surmounted. Again, M. Maury is a devoted admirer of science, and places it far before literature, or rather before works of imagination, for he says:—"Science requires a logical capacity, a power of concentration and perseverance, a genius for abstraction and generalization, which the purely literary man does not want." M. Maury carries his work down to the end of the last century only, for, he says, in the first place, the scientific epoch which then opened is not yet closed; and, secondly, that the science of the nineteenth century has assumed such vast dimensions, and ramified in such an extraordinary manner, that no one man is capable of grasping the threads of such a complicated skein. The progress of science in all its branches, and in other countries as well as in France, is traced with learned care and explained in a lucid and highly-interesting manner. Amongst the subjects which are treated with the greatest fullness are astronomy, the applications of mathematics to physical science, natural history, and chemistry, but nothing is omitted which can explain the growth of each branch of the scientific tree, and the connection which exists between them. M. Maury exhibits complete impartiality in estimating the labours of the philosophers of other nations, and Englishmen will have no cause to complain of his appreciation of their countrymen's achievements.

Meteorological Diagram, showing the daily elements throughout the year 1864. By C. O. F. Cator, M.A. (*E. Stanford*, Charing-cross.) This diagram exhibits, by means of curves, the daily barometric pressure, temperature, direction of the wind, rainfall, and weekly number of deaths in London. The Greenwich mean temperature for each day as well as that of London is given.

Notes.

The Painter's Company's Exhibition of Graining, Decoration, &c.—The Company have issued a notice that as this Exhibition, after five years' existence, has not increased either in the quality or the number of the specimens presented for competition, it is concluded that an annual demand on the trade for specimens is too frequent, and, therefore, the Company have resolved in future to hold the exhibition once in two or three years, according as the wishes of the trade may be expressed. In order to ascertain the general feeling of those interested, and, if possible, to excite a more energetic response on the part both of masters and journeymen than has hitherto been manifested, the Master, Wardens, and Court solicit communications on the subject, which will receive the utmost attention, and which will regulate the future proceedings in relation to the exhibition. Under these circumstances, there will not be an exhibition this year (1865) at the Hall; but one will be held next year if there is an adequate response from the trade, both masters and journeymen.

Water Supply of Paris.—The great works for supplying the houses and city of Paris with water are being pushed forward with remarkable activity. In the *Journal* of the Society, of March 10th, some account was given of the extensive reservoirs at Ménilmontant and Belleville, and of the aqueduct for bringing the waters of the

Dhuis to the metropolis; a few more particulars may now be added. The other day, the loungers in the neighbourhood of the tower of Saint Jacques de la Boucherie, were astonished at the appearance of a number of cast iron pipes, measuring more than fifty-four inches in diameter; these tubes weigh about a ton each, and are to be laid in the tunnels of the new sewers, and will form a portion of the Dhuis aqueduct. A steam-engine of fifteen horse power will raise the water from the reservoir of Ménilmontant to that of Belleville, and the latter, from its elevated position, will supply the highest portions of the city, which at present depend entirely on manual labour for their water. The new sources now being brought into use are calculated to bring to Paris 200,000 cubic metres of water in twenty-four hours; one fifth of this quantity is to come through the Dhuis aqueduct. In order to bring the waters of the Marne to Ménilmontant, the authorities of the city of Paris have purchased the waters and usine of St. Maur, which were the property of Messieurs Darblay and Béranger, the great millers; turbines of about 400 horse-power are now being up set at St. Maur for this service, and two conduits of cast iron are now being laid down, to connect the turbines with the reservoir of Ménilmontant; each of these conduits is nearly nine thousand yards in length.

City Horticulture.—According to the *Building News* Mr. Morris, the architect, has proposed to the authorities to try terrace gardening in Trafalgar-square. He advocates the formation of a new terrace to the south of the Nelson column, the central space being diversified by the introduction of suitable plants, shrubs, and low-growing trees. Portable trees, such as adorn the walks of the Tuileries, would be placed on the Pall-mall terrace, as well as within the enclosed areas of the National Gallery. The effect, observes our contemporary, would be unlike anything which London now offers, and the works of architecture and sculpture would be relieved and harmonized by the presence of horticulture.—The first of a series of city flower shows was recently held, at Albion Hall, which is situated within a stone's throw of the Bank of England by way of Moorgate-street.—The following hints on window gardening for the working classes are by Mr. Walter H. Bosanquet:—*The Flower Pot.*—Do not paint the outside of the flower pot, but keep it as clean as possible. Before making use of a flower pot, if it be new, dip it into clean water; if it be an old one wash it perfectly clean inside and outside. Before filling it with mould, cover the hole at the bottom with a piece of broken pot, and over that, place two or three layers of small stones. Put the coarse mould at the bottom and the fine mould at the top. *The Seed.*—Do not sow the seeds too deep. Sow large seeds, such as sweet peas and nasturtiums, one inch deep, but let small seeds, such as mignonette, be only slightly covered. Until the seeds come up, water them as gently as possible, or cover the mould with wet moss. *Annuals.*—These are raised from seed and only live one year. The sorts called "hardy" and "half hardy" may be raised as window plants. Sow the seeds at the end of March or the beginning of April, and keep those sorts which are called "half-hardy" in-doors until the warm weather comes. Thin the young plants by degrees, but do not leave too many, or they will not have room to grow. *Watering.*—Do not give any water until the mould feels dry, but then water thoroughly, and throw away the water which runs through into the saucer, unless the weather is very warm and dry. Water gently, so as not to wash a hole in the mould or uncover the roots. Use rain water as often as possible, or water which has been long exposed to the air. In winter only give sufficient water and warmth to keep the plant alive. *Light.*—Keep the plants close to the window and turn them as often as the leaves get drawn in one direction. Shade the flower pot from the hot sun, but not the plant, unless the heat is very great. After dark keep the plants, if possible, in a dark, cool room. *Air.*—Give the plants as much fresh air as possible through the window if the air is not very cold. Do not leave door and window open at the same time. Plants which have been exposed to the fresh air become much more hardy than those which are confined in warm, close rooms. *Cleanliness.*—This is equally important for the well-being of plants and men. Whenever the leaves and stalks get dusty or dirty, wash them with a sponge and lukewarm water. Remove your plants from your rooms while you are dusting or cleaning them. Expose your plants as often as possible to warm soft showers, in order to wash and refresh them. *General Directions.*—At night place the plants on or near the ground, or leave the window slightly open. When the surface of the mould becomes hard stir it up carefully so as not to disturb the roots. Pick off all dead leaves and stalks. Do not buy greenhouse plants, but hardy plants, which are suitable for planting out of doors.

New Thermo-Electric Pile.—M. Edmond Becquerel, of Paris, has arranged a new thermo-electric pile, which is said to exhibit great activity. In place of bismuth and copper, he makes use of sulphite of copper, cast at a heat a little above its point of fusion, and metallic copper. One of these discs of sulphite of copper, placed between two of copper, forms an element; and ten of these elements combined, having one extremity plunged in a sand bath maintained at the temperature of 212° Fahrenheit, and the other in cold water, form a pile which is said to be powerful enough to work a telegraphic apparatus.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Antiquaries, 2. Annual Meeting.
Philosophical Club, 6. Annual Meeting.
R. Geographical, 8½. 1. Mr. Lawrence Oliphant, "On the Bayanos River, in the Isthmus of Panama." 2. Mr. R. Cross, "A Journey from the foot of Chimborazo to Bogota, across the Central Andes."
British Architects, 8.
Actuaries, 7. 1. Mr. G. W. Berridge, "On the Graduation of a Table of Mortality." 2. Mr. M. N. Adler, "On Government Insurance Rates and Regulations."
Royal United Service Inst., 8½. Staff-Commander Fred. J. O. Evans, R.N., F.R.S., "The Magnetism of Iron and Iron-clad Ships."

Tues. ...Society of Arts, 8. Cantor Lectures. Dr. F. Crace Calvert, "On some of the Most Important Chemical Discoveries made within the last two years." (Lecture III.)
Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion on Capt. Tyler's paper "On the Festiniog Railway." 2. Mr. Callcott Reilly, "On Uniform Stress in Girder Work."
Zoological, 8½.
Ethnological, 8. Rev. James Brodie, "Observations on the Peculiarities of National Pronunciation, as a means of Tracing the Origin and History of Nations."
Royal Inst., 4. Prof. Frankland, "On Organic Chemistry."

Wed. ...Society of Arts, 8. Mr. F. A. Paget, "On the Wear and Tear of Steam Boilers."
Geological, 8.
London Inst., 12 noon. Annual Meeting.
R. Society of Literature, 4. Annual Meeting.
Archæological Assoc., 8½.

Thurs...Royal, 8½.
R. Society Club, 6.
Royal Inst., 4. Prof. Frankland, "On Organic Chemistry."

Fri.......Royal Inst., 8. Professor Lyon Playfair, "On the Diet of Man, &c."
R. United Service Inst., 3. Colonel R. A. Shafto Adair, "Classification of the Causes of War."

Sat.......Royal Inst., 4. Prof. Bain, "On the Physical Accompaniments of Mind."

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 21st March, 1865.*

3 (281 to 291). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 281 to 291.
116. Royal Courts (Jersey)—Returns.
120. Banda and Kirwee Booty—Further Correspondence.
123. Regimental Quartermasters—Report.
141. Public House Closing Act—Return (a corrected Copy).
146. Police Stations—Correspondence.

150. Poor Relief—Return.
North America (No. 2) (1865)—Papers respecting the termination of the Reciprocity Treaty of June 5, 1854.
Belfast Borough—Report of Inquiry Commissioners as to Magisterial and Police Jurisdiction, &c.

Delivered on 28th March, 1865.

87. Bill—Procurators (Scotland).
66 (v). Railway and Canal Bills—Sixth Report of the General Committee.
128. Army Pensions—Warrant.
133. Woods, Forests, and Land Revenues—Abstract Accounts.
140. Mines—Return.
Ionian Islands—Correspondence respecting Pensions to British Subjects.

Delivered on 30th March, 1865.

94. Bill—General Post Office (Additional Site).
65 (v). Committee of Selection—Sixth Report of the Select Committee.
167. Epsom Common Inclosure—Further Report.
136. Syrup, &c (Breweries)—Correspondence.
144. Bankruptcy Act—Report from the Select Committee.

Delivered on 31st March, 1865.

95. Bill—Tories, Robbers, and Rapparees.
113. Valuation of Land and Heritages (Scotland)—Returns.
144. Bankruptcy Act—Reports, Proceedings, and Appendix.
156. Navy ("Royal Sovereign," &c.)—Return.
177. Metropolitan Sewage and Essex Reclamation Bill—Special Report of Select Committee.

Delivered on 1st and 3rd April, 1865.

91. Bills—Prisons (Scotland) Act Amendment.
96. ,, Pilotage Order Confirmation (amended by the Select Committee, and on Re-commitment).
52 (II). Trade and Navigation Accounts (28th February, 1865).
66 (VI). Railway and Canal Bills—Seventh Report of the General Committee.
110. Revenue, Expenditure, &c.—Returns.
132. (I). Park Lane and Piccadilly Thoroughfare—Plans.
157. Surrey and Sussex, &c., Roads—Return.
164. St. Benet, Gracechurch Street, &c., Benefices—Minutes, Papers, &c.

Patents.

From Commissioners of Patents Journal, April 14th.

GRANTS OF PROVISIONAL PROTECTION.

Air, engines worked by heated—905—J. Pinchbeck.
Bags, securing the frame of travelling—816—L. A. Leins.
Barrels, preventing the leakage of—913—A. V. Newton.
Bleaching, treating the waste liquids obtained in—797—H. Potter.
Boats, apparatus for lowering ships'—890—A. Chaplin.
Boilers, steam—685—E. B. Wilson and J. Howden.
Bottles, stoppers for—814—C. H. Crowe.
Boots and shoes—784—D. Gourley.
Bread, apparatus for cutting—792—W. Berry.
Bricks, manufacture of—939—A. and A. Lockwood, jun.
Bridges, construction of—888—F. A. Leigh.
Cattle, apparatus for preparing food for—927—R. Willacy.
Chimnies, preventing smoky—911—B. Greenwood.
Cigars, mouth piece for—770—T. Oliver and J. W. Musto.
Cloth, apparatus for manufacture of—821—J. Lees and M. Mellor.
Cotton, mules for spinning—919—W. Mayall, J. Knott, and W. Dennis.
Elixir, febrifuge and digestive—874—A. D. Gascon.
Fabrics, apparatus for printing—870—J. Miller and J. Laing.
Fabrics, weaving ornamental—810—J. Macaulay and R. Watson.
Felloes, machine for dressing—794—H. S. Jacobs.
Fire-arms—790—R. J. Gatlin.
Fire-arms—800—A. P. Tronchon.
Floor cloth, machinery for manufacture of—768—J. H. Kidd and J. C. Mather.
Forging machines—882—J. Wright.
Gas burners—876—F. A. Mocquard.
Gas meters—917—J. Bathgate.
Glass, ornamental articles made of—868—J. Williams.
Gun locks—838—D. Arnold
Hammers, atmospheric—953—J. Vaughan.
Hats, felt—941—C. Vero.
Horses, apparatus for grooming—869—J. Norris, jun.
Ink, manufacture of—836—W. E. Newton.
Iron, manufacture of sheet—409—W. E. Newton.
Iron, treatment of certain products obtained in the smelting of—580—T. Horton and D. S. Price.
Iron, manufacture of balls of—957—J. Player.
Iron, reducing and melting—899—W. Brookes.
Lace, manufacture of—971—F. R. Enson.
Links, fastenings for sleeve links—947—H. Jenkins.
Liquids, apparatus for refrigerating—691—J. Henderson.
Looms, motion for—759—E. Pilling and J. Harper.
Machines, apparatus for feeding printing—812—E. Field and F. Wise.
Machines, sewing—830—A. Baillot.
Machinery, cork cutting—638—W. Clark.
Matters, treating fatty—892—S. Childs, jun.
Nails, machinery for cutting—886—R. C. Robinson.
Oils, apparatus for distilling—727—W. E. Newton.
Ores, apparatus for washing—963—H. Simon.
Paper, utilization of materials for manufacture of—703—J. Webb.
Petroleum, casks for storing—834—J. B. Brown.
Photographs apparatus for mounting—915—J. H. Smith.
Photographic productions, ascertaining the presence of fixing agents in—677—T. Reissig.
Pictures, photographic—618—E. Pettit.
Pianofortes—965—B. Johnson.
Points and switches, railway—844—H. C. Hurry.
Power, obtaining motive—840—V. Baker.
Power, apparatus for hand or steam—18—G. Hodgson and J. Pitt.
Pump—314—W. Clark.
Pumps—943—C. D. Young.
Pumps, force—951—R. Baynes.
Railways, construction of rails for—832—W. Loeder.
Railways, street—923—R. A. Brooman.
Railway trains, communication between passengers and guard of—847—A. I. L. Gordon.
Railway hoists, propelling waggons in connection with—895—G. Greenish.
Railway trains, passage of the guard from one end to the other of—866—J. C. Thompson and J. J. M. Green.
Reflectors, apparatus for holding lamp—704—W. Clark.
Rice, treatment of—642—J. H. Johnson.
Safes, fastenings employed in metallic—903—W. Millner and D. R. Ratcliff.
Sealing wax, apparatus for melting—931—W. Bunger.
Spinning, mules for—850—J. Todd.
Spittoons—852—J. H. Johnson.
Steam, motive power by the aid of—949—W. Brookes.
Steel, hardening and tempering—880—E. Savage.
Steel, rolling or forging—925—W. Gray.
Smoke, furnaces for consumption of—862—C. Matthews and J. Fereday.
Silk, apparatus for winding—921—W. Kilbey.
Stoves, &c.—826—J. C. Morgan.
Substances, expressing liquids from pulpy—955—W. E. Newton.
Valves—754—W. Roberts.
Ventilators, hat—961—R. Stanle.
Weaving, looms for—824—G. H. and J. A. Castree.
Weaving, looms for—907—L. Bridge.
Wool separating—511—S. Saville.
Worsted carding—820—H. Oakes.
Yards, machinery for winding—901—A. Turner.

PATENTS SEALED.

2526. R. A. Brooman.
2529. J. T. Cook.
2532. W. E. Gedge.
2533. W. R. Sykes.
2534. A. Hippius.
2538. R. Wright.
2542. W. H. Kelsey.
2554. E. Tomlinson and J. Jones.
2557. C. T. Judkins and W. L. Gosling.
2558. T. Corbett.
2560. J. Cassell.
2562. M. Henry.
2564. J. Maurice.
2570. J. Hart.
2580. W. and F. W. Gilbert.
2581. W. Taylor, H. Harrison, & G. Brown.
2583. W. Buxton.
2586. A. Clavel.
2589. F. Walters.
2605. L. Paviola.
2611. T. Allcock.
2629. G. Schorb.
2634. W. Clark.
8644. W. Clark.
2649. J. Hall, W. Dunkerley, & S. Schofield.
2676. J. Hartshorn & J. Gadsby.
2686. G. H. Devereux.
2699. T. Ivory.
2707. G. Ashcroft.
2745. H. V. Scattergood.
2760. A. V. Newton.
2761. C. T. Burgess.
2809. F. Fearon.
2983. W. J. Matthews.
3215. W. E. Gedge.
257. W. Foster.
330. A. A. Hulot.
364. J. Chubb.
375. A. Krupp.
381. G. Coles, J. A. Jaques, and J. A. Fanshawe.
422. G. Homfray.

From Commissioners of Patents Journal, April 18th.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1043. W. E. Gedge.
1150. H. Lumley.
1101. J. Mackay.
1127. C. D. Abel.
1228. J. G. N. Alleyne.
1233. A. Boyle and T. Warwick.
1063. J. F. Spencer.
1070. J. Dargue.
1084. A. V. Newton.
1090. T. W. Gray.
1146. W. Rose.
1168. S. S. Putnam.
1081. F. A. Le Mat and C. F. Girard.
1085. G. Bedson.
1124. G. T. Bousfield.
1164. J. C. Amos.
1129. R. A. Brooman.
1202. R. Mushet.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

789. T. Kay.
883. J. Chatterton.
845. J. H. Johnson.

Registered Designs.

Odorator—March 24—4704—Gustavus Boehm, 3, Aldermanbury, City, E.C.
Stove Grate—April 11—4705—H. Crichley and Co., Bordesley, Birmingham.
Table Fastener—April 13—4706—W. Tonks and Sons, Birmingham.
Mediæval Reclining Chair—April 15—4707—C. Bevan, 66, Margaret-street, Cavendish-square.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, APRIL 28, 1865. [No. 649. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

May 3.—"On Colonization; its Aspects and Results." By William Stones, Esq.

May 10.—"On the Art of Laying Submarine Cables from Ships." By Captain Jasper Selwyn, R.N.

Cantor Lectures.

The Third Course for the present Session, consisting of six Lectures, "On Some of the Most important Chemical Discoveries made within the last Two Years," by Dr. F. Grace Calvert, F.R.S., F.C.S. (Corresponding Member of the Royal Academy of Turin; of the Société Industrielle de Mulhouse; of the Société Imperiale de Pharmacie de Paris, &c.), is now being delivered on Tuesday evenings, at Eight o'clock, as follows:—

May 2nd.—Lecture 4.—On the Discoveries in Physiological Chemistry.

May 9th.—Lecture 5.—On the Discoveries in the Chemistry of Rocks and Minerals.

May 16th.—Lecture 6.—On the Discoveries in the Chemistry of Metals and Alloys.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting One Friend to each Lecture.

Proceedings of the Society.

Twentieth Ordinary Meeting.

Wednesday, April 26, 1865; Peter Graham, Esq., Member of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Bean, Alfred W., Danson-park, Welling, Kent. S.E.
Dent, William, 21, Newcastle-street, Strand, W.C.
Gover, William, Italian-villa, Lee-road, Blackheath, S.E.
Hancock, C., 6, St. Germain's-villas, Lewisham, S.E.

The following candidates were balloted for and duly elected members of the Society:—

Bourne, Geo. S., R.N., Royal Hospital, Geenwich, S.E.
Brackenbury, Capt. C. B., R.A., 1 Adelaide-place, Woolwich-common, S.E.
Brady, Francis, 12, Limes-villas, Lewisham, S.E.
Brumleu, Charles, 6, St. John's-road, Brixton, S.
Burt, C. J. T., Roadside, West Hill, Putney, S.W.
Clark, Edward, 2, Rose-villas, Montpelier-road, Peckham-rye, S.E.
Cotterill, W., Norbiton-park, Kingston-on-Thames, S.W.
Danby, Thomas, 7, Parliament-street, S.W., and 31, South-grove, Peckham, S.E.
Dolan, H., Park-hill, Clapham, S.
Eden, Frederick Morton, Capel-house, Kew, W.
Farnall, Harry Barrard, Poor Law Board, Whitehall, S.W.
Field, Hamilton, Clapham-park, S.
Folkard, Augustus, Haslam-house, Lewisham, S.E.
Gibson, John, 1, Era-place, Surrey-lane, Battersea, S.W.
Goodwin, Rev. Thomas, M.A., Croom's-hill, Greenwich, S.E.
Gowan, George D'Olier, Wood-lawn, Dulwich, S.E.
Graham, John, 74, Manor-street, Clapham, S.
Harker, George, Uplands, Sydenham, S.E.
Harrison, C. Wrightman, Pneumatic Loom Company, 26, Lombard-street, E.C.
Hawley, Henry J., 4, Foxgrove-road, Beckenham, S.E.
Herapath, John, Catford-bridge, Lewisham, S.E.
Hills, F. C., Denmark-hill, S.
Hoblyn, Thos. Hallam, Bickling, Bishop's Stortford.
Holloway, William, 4, Park-road-villas, Battersea, S.W.
Hosegood, Thomas W., Rosendale-villa, West Dulwich, S.
Jerram, E. J., 3, Cedars-road, Clapham-common, S.
Johnson, John G., Assay-office, 18a, Basinghall-st., E.C.
Legg, George, 61, King William-street, E.C.
Lewis, Thos., Somerset-lodge, 35, London-rd., Croydon, S.
Lord, W. B., R.A., 37, Stockwell-park-road, Brixton, S.
Macandrews, J., Roehampton-lodge, Roehampton, S.W.
McArthur, W., 1, Gwydyr-houses, Brixton-rise, S.
Martley, W., 15, Cedars-road, Clapham-common, S.
Menge, Rev. J. P., Electrical-hall, Park-villas, Lower Norwood, S.
Milnes, William S., 11, Devonshire-road, Greenwich, S.E.
Monk, J. C., 3, Manor-road, Wallington, S.
Moren, George, 38, Threadneedle-street, E.C.
Painter, Henry, 1, Arlington-villas, Loughborough-park, Brixton, S.

Papengouth, Lieut. Oswald C., 12, Bloomsbury-sq., W.C.
Price, Charles J., Carlton-chambers, Regent-street, S.W.
Tefft, Benjamin F., LL.D., 31, Upper King-street, Holborn, W.C.

The Paper read was—

ON THE WEAR AND TEAR OF STEAM BOILERS.

By Frederick Arthur Paget, Esq., C.E.

According to the published report of the engineer of the Manchester Boiler Assurance Company, forty-three explosions, attended with a loss of seventy-four lives, occurred in 1864 in this country. The engineer of the Midland Boiler Assurance Company gives the number as forty-eight, causing the deaths of seventy-five and the injury of 120 persons. These statistics are confessedly incomplete, being, from obvious causes, numerically understated. The Royal Commissioners on the metallic mines report that, in the districts of Cornwall and Devon, boiler explosions are of very frequent occurrence;* and, in these sparsely populated districts, they easily escape the public attention. Explosions, again, which only injure without killing outright, and therefore do not call for a coroner's inquest, also happen without attracting much notice. The figures cited thus understate the destruction and injury to life through boiler explosions, while only a guess can be hazarded as to the annual loss of property they cause. Each explosion testifies to the probability that a number of boilers have been prevented from exploding by mere chance, as also to much unchecked decay and deterioration, which might have been prevented by greater care and more knowledge. Besides, apart from the disastrous results of an explosion itself, the undue wear and tear of boilers means the suspension of the workshop or factory and the demurrage of the steam-vessel. With respect to the causes of explosions themselves, "there are," to use the words of the late Mr. Robert Stephenson,† "but few cases which do not exhibit undue weakness in some part of the boiler;" and the same opinion appears to be held by Professor Faraday.‡ The opinion that an explosion is rather due to the weakness of the boiler than to the strength of the steam may in fact be said to be universal. There is, indeed, a very complex train of mechanical, chemical, and physico-chemical forces, leading to the deterioration and consequent destruction of a steam-boiler, and it is probable that no other metallic structure is subjected to such complicated conditions. The pressure of the steam and the heat of the fire produce mechanical effects, while both the burning fuel and the water react chemically on the plates and in accordance with their varying chemical properties. Each of these agents play, so to speak, into the other's hands, furthering and quickening the other's progress. It is difficult to distinguish with strictness between the effects of each; and it is mainly for the sake of convenient examination that they can be classified into:—1. The effects of the pressure of the steam; 2. the mechanical effects of the heat; 3. the chemical effects of the fuel; 4. the chemical effects of the feed-water.

The Direct Effects of the Pressure of the Steam.

In calculating the working strength of a cylindrical boiler, the plates are assumed to be under a static load, and to be submitted to a tensile strain. The former of these assumptions is seldom, and the second is never correct. There are two principal causes that tend to exert impulsive strains on the sides of a boiler:—1. The sudden checking of the current of steam on its way from the boiler to the cylinder; 2. quick firing, attended with too small a steam room; and both may sometimes be found to act in combination. To the first of these causes, the explosion, for instance, of one of the boilers of the *Parana* steamer, at Southampton, a few years ago, has been ascribed by the Government engineer surveyor;* to the second, the explosion of the copper boiler of the *Comte d'Eu* yacht, in France. According to Dr. Joule, the mere dead pressure of an elastic fluid is due to the impact of its innumerable atoms on the sides of the confining vessel. When the motion of a current of steam is suddenly checked, as by the valve in its passage from the boiler to the cylinder, its speed and weight cause a recoil on the sides of the boiler analogous to the effects of the, in this case, almost inelastic current of water in the hydraulic ram.† This action is necessarily most felt with engines in which the steam is let on suddenly, as in the Cornish and other single-acting engines, working with steam valves suddenly affording a wide outlet, and as suddenly closing. It produces such phenomena as the springing or breathing of cylinder covers, and the sudden oscillations of gauges, noticed long ago by Mr. Josiah Parkes and others.‡ Some years ago, while standing on a boiler working a single-acting engine, and with a deficient amount of steam-room, the writer noticed the boiler to slightly breathe with every pulsation of the engine. The same action has been observed by others with boilers the steam-room of which is out of proportion to their heating surface. The intensity of the instantaneous impulses thus generated would be, as Mr. Parkes observes, difficult to measure, but their repeated action must rapidly affect the boiler at its mechanically weakest points. The more or less sudden closing of a safety-valve while the steam is blowing off would evidently produce the same effect; and this view is strengthened by the fact that the great majority of locomotive boilers—in which while at work there is no such sudden call on the reservoir of steam as in the Cornish engine—explode while standing with steam up at the stations.§ It is not denied that, in the case of a locomotive, the mere extra accumulation of steam from the safety-valves being screwed down above the working pressure will also come into play. But there can be little doubt that most boilers are subjected sooner or later, and with more or less frequency, to an impulsive load. This being the case, this consideration alone would demand a factor of safety of *six* in the designing of steam boilers. The Commissioners on the application of iron to railway structures, in their third conclusion on a mass of evidence which has made their investigations the most valuable ever conducted on the strength of materials, say:—"That, as it has been shown, that to resist the effects of reiterated flexure, iron should scarcely be allowed to suffer a deflection equal to one-third of its ultimate deflection, and since the deflection produced by a given load is increased by the effects of percussion, it is advisable that the greatest load in railway bridges, shall in no case exceed one-sixth of the weight which would break the beam when laid on at rest in the centre."||

Emerson showed, more than sixty years ago, that the stress tending to split in two an internally *perfectly*

* Report of the Commissioners on the Metallic Mines. Presented to both Houses of Parliament by command of Her Majesty, 1864, p. xxi.

† Proceedings of the Institution of Civil Engineers, 1856, p. 281.

‡ Proceedings of the Institution of Civil Engineers, 1852, p. 392.

* Rudimentary Treatise on Marine Engines and Steam Vessels, etc. By Robert Murray, C.E., Engineer Surveyor to the Hon. Board of Trade, p. 74—78.

† Instituto di Scienze. Milano, 1829.

‡ Transactions of the Institution of Civil Engineers. Vol. 3.

§ Reports of the Inspecting Officers of the Board of Trade, 1850—64. (The four locomotive boilers which burst last year all did so while standing. Neither the primary rupture leading to the explosions, nor the secondary rupture caused by the explosion, took place through the rivet holes.)

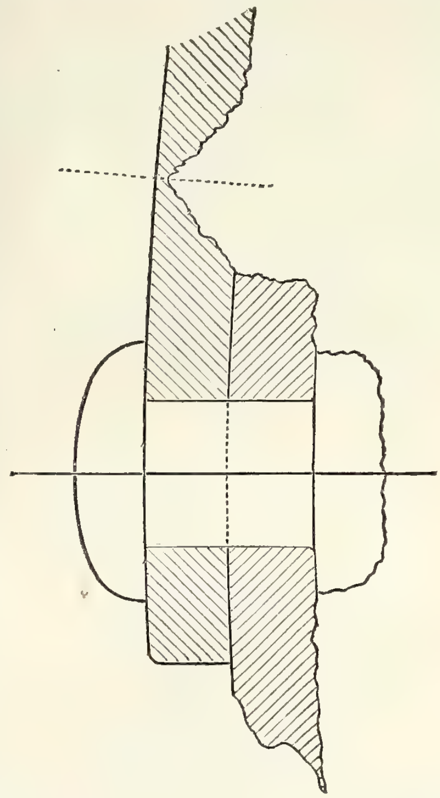
|| Report of the Commissioners appointed to inquire into the Application of Iron to Railway Structures. xviii.

cylindrical pipe, submitted to the pressure of a fluid from the interior, is as the diameter of the pipe and the fluid pressure. He also showed "that the stress arising from any pressure, upon any part, to split it longitudinally, transversely, or in any direction, is equal to the pressure upon a plane drawn perpendicular to the line of direction." As in a boiler the thickness of the metal is small compared with the radius, the circumferential tension has been assumed to be uniformly distributed; and the strain per unit of length upon the transverse circular joint being only half that upon the longitudinal joints, the strength of the latter has been taken as the basis of the calculations for the tensile strength of the joints. But in taking the internal diameter of the boiler as the point of departure, the internal section has been assumed to be a correct circle, which would only be practically true in the case of a cylinder bored out in a lathe, and never in that of a boiler. Two of Emerson's corollaries from his first proposition have in fact been neglected. He shows that if one of the diameters be greater than another, there will then be a greater pressure in a direction at right angles to the larger diameter; the greatest pressure tending to drive out the narrower sides till a mathematically true circle is formed. The second is that, "if an elastic compressed fluid be enclosed in a vessel, flexible, and capable of being distended every way, it will form itself into a sphere."* A number of proofs can be adduced that both these influences are more or less at the bottom of the wear and tear caused by the direct action of the steam.

From 1850 to 1864 forty locomotive explosions causing a loss of human life have occurred in the United Kingdom. The Board of Trade reports in the Bluebooks presented to Parliament, and more especially those by Captain Tyler, R.E., probably form the most valuable and connected series of records extant on boiler explosions. This is more especially the case with regard to wear and tear caused by the direct action of steam unmasked by the effects of the fire, as the barrel and outside fire-box of a locomotive cannot be said to be under the direct action of the heat. Perhaps the vibration of the boiler through the motion on the line may intensify this action, but it is clear that vibration cannot be a primary cause. The majority of the reports are illustrated by careful drawings. Eighteen of the forty boilers gave way at the firebox—eleven from the crown of the inside fire-box being blown down upon the tube plates; seven from the shells or sides giving way. Twenty burst at the barrel; and two explosions may be ascribed to miscellaneous causes, from an originally defective plate, and from running off the line. Leaving out all those which occurred at the fire-box, as the majority of these might be ascribed to other influences than direct pressure, all the twenty explosions of the barrel could be traced either to internal furrows or to cracks, both running parallel with one of the longitudinal joints of one of the rings forming the barrel. All the joints which thus gave way were lap-joints; and the furrows or the cracks (and the former greatly preponderate in number) occur at the edge of the inside over-lap, and, therefore, just at the point where the diminution of diameter caused by the lap-joint would be most affected by the pressure of the steam. (See Fig. 1.)

The plate at the channels shows distinct traces of lamination through the cross-bending, and it is probable that plate of a good material will gradually laminate, while

Fig. 1.



(Full size cross section of the furrowed longitudinal joint in the fire box ring of a boiler which exploded at Overton station, on the 30th May, 1864. It does not differ from other furrows.)

inferior metal will crack through in much less time. Nor are these furrows found with only lap-joints. Butt-joints, with a strip inside the boiler, and thus destroying the equilibrium of internal pressure, have been found to be attended with similar furrows. Channels of exactly the same character have been observed in locomotive boilers with lap-joints, which have exploded in Germany.*

Similar furrows, again, have been noticed in marine boilers, and in old boilers generally, longitudinal furrows being of course about twice as dangerous as those appearing transversely. The smoke-box tube-plates of inside cylinder-locomotive engines have been found to be similarly influenced by the racking action of the engines, showing furrows around the cylinder flanges. A parallel case is often found in Lancashire with the end-plates of double-flued Fairbairn boilers, which may have been too stiffly stayed to the barrel. Circular furrows, caused by the confined motion of the end-plates are sometimes found at the base of the angle iron rings jointing the internal flues to the end-plates. But furrowing seems with no kind of boiler to be more felt than with locomotive boilers. This is due to the higher pressure, to the thicker plates causing a coarser lap, and more especially to the fact that the unstayed barrel cannot be thoroughly examined without drawing the tubes, thereby enabling the furrow to enlarge itself unnoticed.

The inside fibres of a plate bent up while cold are necessarily initially in a state of compression. When the pressure from the inside comes on, striving to form a perfect cylinder, the plate gets bent to and fro by its own

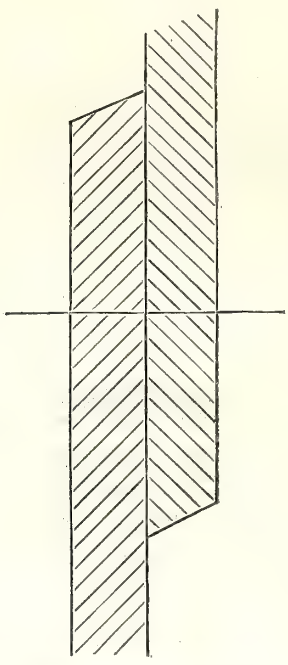
* The action of a fluid pressing with equal forces in all directions can be evidently represented as to force and direction by innumerable radii of equal length led from a single point in all directions. Upon this principle may be explained the spherical shapes of soap bubbles, of the bulbs of thermometers (blown while the glass was in a plastic state), of the thin india rubber balls, used as playthings, and which are formed by forcing air into india rubber tubes closed at one end. Gas and air bubbles in water are necessarily flattened by the hydrostatic pressure. It is upon that principle that a gun of soft ductile iron often bulges out at the breech.

* Organ fuer die Fortschritte des Eisenbahnwesens. 1864, p. 159.

elasticity on one side, and by the pressure on the other. If the iron be brittle, it may crack right through; if ductile, the outside fibres gradually lose their elasticity, and, necessarily aided by other causes, crack away. This action is progressive, and probably very rapid towards its later stages. Once a weak place formed itself it would have to do more and more of the work. Even when pulled by the direct tension of the testing machine, a lap-joint behaves in a somewhat similar way. For instance, a half-inch lap, solidly welded by Bertram's process, has only half the strength of the solid plate;* while the $\frac{3}{8}$ inch lap-weld has actually two-thirds of the strength of the entire plate.

Messieurs Jean Piedbœuf and Cie., of Aix-la-Chapelle, Düsseldorf, and Liege, who turn out annually upwards of one thousand steam boilers, use a lap-joint which probably gives slightly better results as to furrowing, while it is much easier to caulk, and must be therefore less injured by that process. (See Fig. 2.)

Fig 2.



(The edges of the plates are cut to an angle of 65° by means of inclined shears.)

There is, however, another important appearance to be noted with respect to these furrows. An iron cylindrical vessel under internal pressure would of course rupture long before it could assume a spherical shape, from its ranges of elasticity and of ductility being so short. But it may be said to be undergoing three distinct stresses in as many directions. There is a stress acting on the ends, and tending to rupture the boiler in two halves in a direction parallel to the axis; there is the stress which is hoop tension in a true circle, but which acts with a cross-bending strain in an ordinary boiler; and there is the stress which tends to make it assume the shape of a barrel, or to bulge it out in the centre of its length. The precise action on a material of several strains like this is a portion of the strength of materials which is still completely unknown. Its probable effects might be illustrated by the ease with which a stretched india-rubber ring is cut through with a knife, or that with which a column under compression is broken by a blow from a hammer, or by the similar ease with which a tube under tension is split by a sharp blow; in fact, the operation of caulking a defective boiler under steam seems thus to often give it the finishing stroke which causes an explosion. The new boiler which burst from a defective plate at the Atlas Works, Manchester, in 1858, and that which burst through a crack at a longitudinal joint last January, at Peterborough, both gave way whilst being caulked. This again accounts for the fact that adjacent boilers sometimes explode one after the other, pointing, at the same time, to the danger into which a sound boiler may be thrown by an explosion. Upon the same principle it is probable that the modern guns, built up from strained rings, will be easily put *hors de combat* by shot. The probability is that a number of simultaneous strains in different directions diminish the elasticity of the material that would allow it to yield in any given direction. However this may be, it will be seen that it is only the pressure on the ends of the boiler acting parallel to the axis, and tending to tear the cylinder through transversely, which bears fairly on the rivetted joint, or rather on that metal between the rivets which is left after punching. Unless the cylinder be perfectly correct inside, the circumferential strain resolves itself into cross-bending, shifting the dangerous strain from the iron left after punching to the metal at the over-lap. With respect to the stress tending to bulge the cylinder in the centre, it is clear that if we suppose a strip cut out from the entire length of the boiler, each portion of the length of this strip could be regarded as a beam under an uniformly distributed load. As, however, with the lap joint, there is a double thickness of metal transversely, that joint is the strongest and stiffest portion to resist the stresses tending to bulge out the cylinder in the middle, and also to tear it into two halves. This affords some justification for the belief of old boiler-makers, before rivetted joints were tried under a direct tensional load, that the joints are the strongest parts of the boiler. And, indeed, this is what we find in practice. The thinnest portion of the longitudinal furrows is generally exactly in the middle of the plate, and this is caused by the longitudinal stress, which is acting at right angles to the transverse cross-bending stress. A strip cut from joint to joint is, in one respect, in the condition of a beam supported at both ends, uniformly loaded throughout its length, and, according to known principles, therefore giving way in the middle. (See Fig. 3.)

The middle ring of the boiler which burst on the Metropolitan Railway last year, and the fragments of which were examined by the writer, also first given way at a furrow. Captain Tyler reports that at from $16\frac{3}{4}$ to 19 inches from the transverse joint, or just about the middle of the plate, there was "very little metal left holding," while it gradually got to its original thickness of $\frac{3}{8}$, as the groove receded from the centre of the plate and towards the transverse joints at each side.

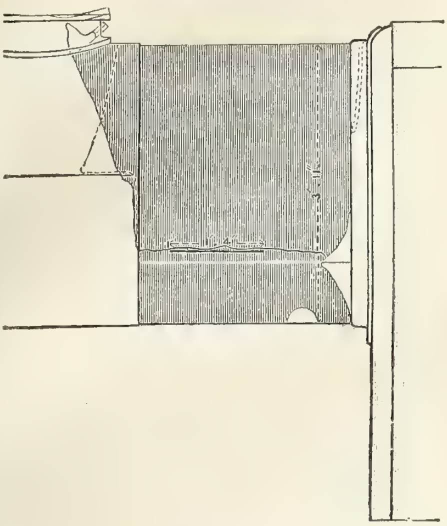
It is impossible to deny the existence of an infinite number of stresses acting on the sides of a vessel undergoing fluid pressure, producing what, for want of a better term, might be called a "bulging strain." Instances of this action may be noticed in the sketch of the leaden pipes given by Mr. Fairbairn,* which were bulged out in the middle by internal pressure, as also in the fire-box sides† influenced by the same means, and in the centre of the surface. Unaccountably enough, the effect of such a strain on the ultimate resistance, and, above all, the elasticity, of materials, has been entirely neglected by investigators, and there are no published data on the matter. The effect of the internal pressure is evidently resisted by a double thickness of plate at the joints, so

* "Recent Practice on the Locomotive Engine," p. 5.

* "Philosophical Transactions, 1858," p. 402.

† "Useful Information for Engineers, 1856." Appendix, xviii.

FIG. 3.



(From Captain Tyler's report, dated 30th June, 1864, on the boiler explosion at the Overton station of the London and North-Western Railway. The plate torn off is shaded, the course of fracture on the other side of the boiler is dotted, while the furrow is shown by the thick horizontal line.)

that the load on the middle of a single ring may be considered as determining the weakest part of the boiler. One of the rings of the Great Northern boiler which exploded on the Metropolitan Railway last May had a length transversely of about (say) 36 inches from lap to lap, with an inside diameter of 45 inches. If we now suppose a strip one inch broad cut from the 36 inch long plate, parallel to the longitudinal axis of the boiler, this strip is, supposing there be a pressure of 100 lbs. to the square inch, uniformly loaded with 3,600 lbs.—equal to a transverse load of 1,800 lbs. at the centre. Supposing the plate to form a true circle, a hoop one inch wide of the ⅜ plate would be subjected, circumferentially, to a tensile load of 6,000 lbs. per square inch, while (leaving out the diminution of area at the ends through the flue tubes) each portion of the circle, about 1 inch broad and ⅜ inch thick, is subjected to a load of about 1,125 lbs. acting parallel to the axis of the boiler.

To construct a general rule or formula that would take into account the distorting effects of the lap or of the welt of butt-joints would be impracticable; but it is clear that the usual mode of calculating the strength of a cylindrical boiler from the tensile strength of joints tested by weights, or hydraulic pressure, directly applied, is far from being correct. It is only tolerably correct with scarf welded joints, or with butt joints with outside welts. Even here, the hoop tension of the true cylinder is resolved into a cross bending strain, if the cylinder does not not form a correct circle internally. The usual formula would be practically correct, if the boiler were prevented from altering its shape during the impulses sometimes given by the steam, and the quieter buckling action caused by the alternate increase and fall of the pressure. In fact a boiler, like a girder, does not merely demand a high ultimate strength, but also a stiffness which is the protection against alternative strains—against buckling or collapse.

Disregarding the effects of the thickness of the material, a perfect cylinder should theoretically afford the same ultimate resistance, whether exposed to external or internal pressure. Its resistance to collapse should indeed be greater, as most materials give more resistance to compression than to tension. This is not the case, as the distortion of form progressively weakens an internal flue, by increasing the load on its surface, while the contrary is rather the case with the boiler exposed to internal tension. Before Mr. Fairbairn showed the inherent weakness of flue tubes, their frequent explosions through collapse were ascribed to spheroidal ebullition and other similar causes. They are now, according to the engineer of the Manchester Boiler Association, stronger than the shells, by means of the T-iron and angle-iron bands now generally used, and also by the excellent seams introduced by Mr. Adamson so long ago as 1852.* While T-iron and other bands could be used for the barrels of boilers not exposed to the fire (as is recommended in France† and by the Board of Trade Inspector of Railways), Adamson's seams reversed would probably form excellent transverse joints for a shell fired from the outside, and, with a boiler like this, thin and narrow plates could be used, affording a stronger and tighter lap-joint. With a construction of this kind little or no deflection or bulging could occur, and the sectional area of the plate and the rings would really give the strength of the boiler.

2.—THE MECHANICAL EFFECTS OF THE HEAT.

While a maximum of stiffness to the mechanical action of the pressure is required in a steam boiler, a maximum of flexibility to the irresistible mechanical force of heat is of no less importance. For instance, a great advantage of some of the forms of strengthening rings for internal flues is that they allow the use of thinner plates; together forming a structure of great flexibility to complicated thermal influences. The longitudinal expansion of inside flues like this is taken up by a slight spring or swagging at each joint, and the end plates of the shell are not unduly strained by the combined efforts of the internal pressure and the expansion due to heat. This is one way in which defective circulation, or a sudden current of cold air or of water, can act on the structure, by unequally straining the plates; and, although it seems probable that the effects said to have been thus produced, are, to some extent, due to other causes, they point to the importance of keeping the temperature of the plates as low as possible. One protection against effects of this kind is the gradual diffusion of heat, produced by its conduction to and from the different plates. It is a general belief with engineers that a pressure of steam strains a boiler more than cold hydraulic pressure; but it is unsettled as to what amount and in what exact way. The basis of an examination of the kind would have to be sought in an exact determination of the temperature of a plate which is transmitting the heat to the water, and this has not yet been determined with any accuracy. The fact is, as is remarked by M. Péclet, who has given great attention to these questions, the different phenomena involved are extremely complicated. It is clear that the plates must always be at a higher temperature than the water, as it is by the difference of temperature of the two surfaces of the plate that it is traversed by the heat. He supposes that, though the flow of heat through the plate is inversely as its thickness (while it is directly as the surface and as the difference of temperature between the outside and inside faces), yet the flow of heat would be the same through a thicker plate, from the greater difference of temperature between the two surfaces.‡ He does not seem, however, to be aware of the important law demonstrated by Mr. J. D. Forbes, that the conducting power of, for instance, wrought iron, rapidly diminishes at the higher temperatures. At 200° C. it has little more than one half the conducting power it has at 0°.§ At yet higher temperatures it might probably be proved, if an applicable instru-

* Specification No. 14,259.

† Bulletin de la Société Industrielle de Mulhouse, 1861, p. 532.

‡ Traité de la Chaleur. Vol. 2, p. 393.

§ Royal Society of Edinburgh, 28th April, 1862. "Experimental Inquiry into the Laws of the Conduction of Heat in Bars, and into the Conducting Power of Wrought Iron."

ment for registering higher temperatures were in existence, that the powers of conduction are still less. Some of Mr. Peclet's experiments also seem to be vitiated by his disregard of Dr. Joule's discovery that water is heated by being mechanically stirred up. It is, however, certain that water can only moisten a metallic plate when at a lower temperature than 171° C. As soon as the water gets thus repelled, the heat radiated by the metal is reflected back from the surface of the liquid; the metal gets hotter and hotter, with a corresponding diminution of its conducting powers; its outside, exposed to the fire, would more or less oxidise, and with a similar result; and a like effect is produced on the inside—on the roughened surface of which incrustation would rapidly adhere, forming a calcareous coating, conducting with about sixteen times less power than iron.* All these tendencies are of a progressive character, leading to very high temperatures in the plate, even to a red-heat. This tends to explain how rivet-heads close to the fire are soon burnt away by the friction of the current of heated gases on the red-hot metal; how thick fire-boxes are sooner burnt out than lighter ones, the process being often arrested at a certain thickness; how internal flues of thick plates so often give trouble; how externally fired boilers are most deteriorated at the corners from the junction of the three plates; and similar results well known to practical men. Another proof that thin plates conduct more heat than thick plates is afforded by some experiments lately made in Prussia, with two egg-end boilers, exactly similar in every respect, except that one was constructed of steel plate ¼ inch, while the other was of wrought-iron about ½ inch thick. The steam generating power of the steel boiler was to that of iron as 127·49 to 100†—a result which can only be accounted for by the relative thickness of the plates. Thick plates are also more liable to blisters, one of which would considerably diminish the conducting power of the spot where it happened to form.

While it is certain that boiler plates can assume very high temperatures, even up to red-heat, authorities differ as to the diminution of ultimate strength which is caused by heat, while its effect on the elasticity of the plate has been scarcely attended to. The experiments on the ultimate tenacity of iron at high temperatures, conducted by Baudrimont,‡ Seguin, and the Franklin Institute, can scarcely be looked upon as of much value, for they were made on a very small scale, and with no regard to the temporary and permanent elongations—or to the effect of heat on the elasticity and ductility.

Mr. Fairbairn§ observed no effect on the strength of plate iron up to almost 400° F. At a "scarcely red" heat the breaking weight of plates was reduced to 16·978 tons from 21 tons at 60° F.; while at a "dull red" it was only 13·621 tons. MM. Tréméry and P. Saint Brice,|| aided by the celebrated Cagniard Latour, found that at nominally the same temperature (*rouge sombre*), a bar of iron was reduced in strength to one-sixth of its strength when cold. This is much greater diminution of strength than that found by Mr. Fairbairn. Apart from other causes, this might easily be due to the fact that incandescent iron affords a different tinge during a dull day to what it does in a clear light. In fact, the great impediment to all these investigations is the want of a thermometer for high temperatures; but M. Tréméry's result is perhaps more conformable with daily experience. Mr. Fairbairn's data would show that the ultimate strength of wrought iron is reduced to about one-half; but M. Tréméry's result explains the generally instantaneous collapse of flues when red-hot, and which have been of course originally calculated to a factor of safety of *six*.

A most important question is the effect of temperatures, whether high or low, on the elasticity of the material—whether iron will take a permanent set with greater facility at a high temperature? These data are really more important than those on the ultimate strength, as they would show the influence of temperature on the elastic limit. Here again is a vacancy in existing knowledge, which can scarcely be said to be filled up by the few experiments of the late M. Wertheim on very small wires.* He found, however, that the elasticity of small steel and iron wire "increases from 15° C to 100°, but at 200° it is not merely less than at 100°, but sometimes even less than at the ordinary temperature."

There is, however, another very important point with respect to wrought iron, which has scarcely received the attention it deserves. As would appear from a number of phenomena, there seems to be a sort of thermal elastic limit with iron. When heated, and when its consequent dilatation of volume does not exceed that which corresponds to (perhaps) boiling point, it returns to its original dimensions. Beyond a certain temperature it does not contract again to its pristine volume, but takes a permanent dilatation in consequence, apparently, of its elastic limits having been exceeded. A number of observers† have determined the fact with cast iron, and though wrought iron has not been expressly investigated in this direction, there is no doubt that it exhibits a similar behaviour. Thus, a number of years ago,‡ an Austrian engineer, named C. Kohn, remarked that a boiler about 12 metres long and 1·57 in diameter, with a thickness of plate of 0.011, permanently expanded, at a temperature corresponding to a steam pressure of 5 atmospheres, (153° C.) by 0.07193, and did not, when cold, return to its original dimensions. The same thing has been noticed, by means of very accurate measurements, with other boilers. A number of experiments by Lt.-Col. H. Clerk, of Woolwich, on wrought iron cylinders and plates,§ bear distinct evidence to a dilatation of volume in wrought iron, when repeatedly heated and suddenly cooled. In experiment 7, for instance, "two flat pieces of wrought iron, each 12 inches long, 6 inches deep, and ½ inch thick, were heated and cooled twenty times, one being immersed to half, and the other to two-thirds, its depth in water. That immersed one half contracted or became indented on the ends fully ·3 inch; the other had similar indentations, but only to one-half the amount. They both turned up into the form of an arc," the *convex* side of which appeared in the portion heated and cooled. Unfortunately, the specific gravities of the different portions were not tried by Colonel Clerk. A succession of trials of the kind produced cracks in the metal, thus explaining how boiler plates are cracked by imperfect circulation and by cold feed-water let in near the fire; and, the thicker the plate, the more permanent dilatation of volume and consequent danger. Mr. Kirkaldy found that "iron highly heated and suddenly cooled in water, is hardened," being injured, in fact, if not afterwards hammered or rolled. This permanent dilatation of volume must be necessarily accompanied with a diminution of specific gravity, thus affording another close analogy between straining iron by loads in excess of the mechanical elastic limits, and straining by heat. Lajerhelm|| found long ago that the specific gravity of iron is diminished by strains in excess of the limit of elasticity, and this result has been completely confirmed by Mr. Kirkaldy's numerous experiments. The smith calls iron "burnt" which has been rendered brittle in working through the often repeated applications of heat, or through

* Traité de la Chaleur. Vol. i., p. 391.

† Verhandlungen des Vereins zur Beförderung des Gewerbfleisses in Preussen, 1862, p. 140.

‡ "Annales de Chimie et de Physique," 3, s. 30, p. 304, 1850.

§ On the Tensile Strength of Wrought Iron at Various Temperatures. Reports British Association, 1856, p. 405.

|| Annales des Mines. 2 serie. Vol. iii., p. 513.

* Comptes Rendus, xix., 231.

† Percy's Metallurgy, vol. ii., p. 872.

‡ Technologiste. 1850-51, p. 102.

§ Proceedings of the Royal Society, March 5, 1863.

|| Poggendorf's Annalen, 2 s., vol. ii., p. 488.

too high a temperature. Iron rendered brittle by strains in excess of the limit of elasticity has been long popularly termed "crystallized." Both these states are accompanied with a dilatation of volume and attendant hardness and brittleness, and both seem to be referable to very similar causes. In fact, a very general belief exists that very ductile good iron, used in the form of a steam boiler, soon gets brittle. There are some applications of metal to a steam boiler peculiarly liable to be strained beyond the limits of elasticity; by mechanical force, by the mechanical force of expansion and contraction, and by dilatation of volume through heat all three acting simultaneously. Such is the case with fire-box stay-bolts. Accordingly, they are found to get very brittle when of wrought iron—which is a much less ductile metal than copper. Mr. Z. Colburn states that he has "frequently found these stays (where made of wrought iron) to be as brittle, after a few years' use, as coarse cast iron." He has "broken them off from the sides of old fire-boxes, sometimes with a blow no harder than would be required to break a peach stone."*

3.—The Chemical Effects of the Incandescent Fuel.

Whatever physical changes may be induced in iron by the long continuance of a high temperature which is not succeeded by the application of the impact of the hammer or the pressure of the rolls, it is certain that long-continued red heat leads to the loss of its metallic consistency. Its surface gets converted to a greater or less depth into forge scales, which, according to Berthier, consist of a crystallized compound of peroxide and protoxide of iron. The mechanical action of the gases—and especially of the free oxygen contained in every flame—forced at a high velocity by the draught past the more or less heated plates, would also aid these chemical combinations—upon the same principle as iron filings, thrown through a gas flame, burn in the air; and upon the same mechanical principle as the incandescent lime is worn away by the flame of the oxyhydrogen blow-pipe. These actions would take place with any fuel, even with pure charcoal. But when mineral fuel, which mostly contains more or less iron pyrites, is used, there is much more danger to the plates, especially over the fire, in getting red hot, as the flames would then hold sulphurous acid, and often volatilised sulphur. A familiar illustration of an action of this kind is afforded by the fact that a piece of red-hot iron plate can be easily bored through by means of a stick of sulphur, the combination forming sulphide of iron. Dr. Schafhaeutl, of Munich, has given great attention to the changes in plates subjected to the action of fire; twenty-five years ago he read a paper before the Institution of Civil Engineers,† and more recently he has published an essay, both on this subject, in a Munich periodical.‡ He has brought forward a number of facts, founded on chemical analyses of plates of exploded boilers, showing the danger, due to chemical action alone, when the plates of a boiler become red hot. He notices that the iron of the inside of the plates, in getting red-hot, decomposes the water, and combines with the oxygen thus freed. It also loses some of its carbon. The outside combines with the free oxygen and with any sulphurous acid in the flame. He states that iron made with pit coal is much more affected than charcoal-made iron; becoming laminated at the original joints in the pile out of which the plate has been rolled. It is possible that portions of oxide are carried into these joints, and it is at any rate certain that iron gives way easiest at these places. This points to the great value of really homogeneous plates, such as those of cast steel, in which homogeneity has been obtained by the only known means of fusion.

* Steam Boiler Explosions, 1860, p. 32?

† Transactions of the Institution of Civil Engineers. Vol. iii. 1840; p. 435.

‡ Bairisches Kunst und Gewerbeblatt. June, 1863.

The remarkable diminution of elasticity and of tenacity caused by the combination of the red hot iron with sulphur; the absence of all elasticity and tenacity in the oxides of iron, show that, even if a flue do not at once collapse, or a shell explode, through getting red-hot, the boiler is more or less injured every time it gets overheated. A defective circulation, by permitting such a temperature as to drive the water off the plate, would soon lead to local injury. Particular spots in externally fired cylindrical boilers are sometimes, as is stated by Mr. L. Fletcher of Manchester, thus affected, and in an apparently mysterious way. A new boiler in which a heap of rags were accidentally forgotten, had the spot burnt out in a few days,* doubtless through the resulting defective circulation and its consequences. The plates just above the fire of internal flues also suffer in this manner. It is perhaps possible that turned joints, secured by bolts, and allowing an occasional reversing, or rather rotating, of the ring, might, in some cases, be here of service. At any rate, universal experience proves that the thicker the plate the easier does it get red hot; and these chemical facts also point to the desirability of a minimum of thickness. In fact, the wearing away of the plates through these causes, if mechanically strong against pressure, often gets arrested at a certain thickness. In Germany and France, some of the best manufacturers still make the plates over the fire of, for instance, inside flues, slightly thicker than anywhere else; but the combined chemical and mechanical actions of the heated fuel cause most wear and tear in a thick plate, and thus justify American practice in this respect. In that country, fire-box plates of good charcoal iron are made only $\frac{5}{16}$ or $\frac{1}{4}$ of an inch thick, and, with stays four inches apart, give good results under nearly 150 lbs. steam pressure.

4. The Chemical and Physico-Chemical Effects of the Feed-water.

The wear and tear of a boiler which occurs in the form of corrosion, properly so-called, may be divided into two principal kinds:—(1.) Internal, and (2.) external. The progress of both is necessarily intensified by the mere effects of temperature; each, however, has its strongly-marked, distinct character—not merely as to position, but also as to origin and results.

A steam boiler is in the position of a vessel into which large volumes of water are continually forced; while the heat applied, driving off all volatilizable matter, leaves behind a concentrated solution with a chemical character dependent on that of unvolatizable matters in the feed-water. The specific gravity of the substances found in the water naturally causes them to sink towards the bottom, at which part the solution is generally more concentrated, however much it may be stirred up by the ebullition. Mr. J. R. Napier lately stated that a piece of zinc "about four feet long, by three inches broad, by three-sixteenths thick, placed in a marine boiler for three weeks" to a depth of 18 inches in the water, showed a corrosion which rapidly decreased "up to the highest part, which, in the steam, appeared to be little affected."† This accounts for the fact that all boilers, even those internally fired, like locomotive boilers, have their plates most affected towards the bottom, and that internal corrosion always shows itself to a greater extent below the water line. The *bouilleur* of the form of boiler known as the French boiler is also generally more affected than any other part. To resist this sort of slow action, it is clear that the more the bulk of metal the better, and it is for this reason that the bottom plates of most marine boilers are made thicker, while these same plates in locomotive boilers have to be often renewed. Any chemical or physico-chemical action of the kind is of course intensified by temperature, and this is one of the causes why externally fired boilers give way most a little in front of

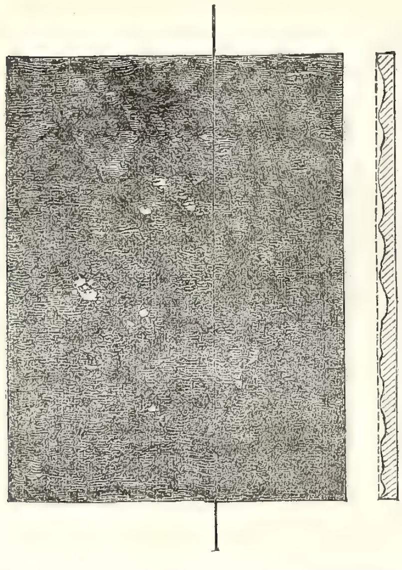
* Pêclet, Traité de la Chaleur. Vol. ii., p. 73.

† Institution of Engineers in Scotland, Session 1864—5.

the furnace. But the plates above the water-line also get more or less corroded, and not merely with the usual character of rusting, but in that peculiar form known as pitting, which generally shows itself much more strongly marked below the water-line.

The presence of a concentrated solution of an acid or alkaline character, kept at a high temperature for years in contact with iron plates, would be sufficient to account for much corrosion. But the internal corrosion of steam boilers has many features of such a mysterious character, that no accredited explanation of its attendant phenomena has yet been put forward. In the first place, plates thus attacked show a number of irregular holes like a pock-marked human face, or like the small craters seen on the moon's surface. (See Fig. 4.) The writer has

Fig. 4.



(The internal surface of a plate of an old wrought iron boiler, showing one-quarter of the full size, the ordinary appearance of pitting.)

also sometimes observed two or three little irregular excavations like this in a plate otherwise showing a large surface quite intact. Sometimes the plate is most pitted round a projecting bolt; at others, one plate will be perfectly sound, while that rivetted to it will be almost eaten away, both having been the same time at work, and under, of course, apparently exactly similar conditions. With locomotive boilers this pitting has been ascribed to galvanic action between the brass tubes and the iron plates. But it is notoriously well-known to locomotive superintendents, that boilers with iron tubes are often worse pitted than those which have run the same distance with brass tubes. Besides, all iron boilers, with or without brass, whether used for stationary, locomotive, or marine, purposes, are subject to pitting.

An explanation which seems to meet all the circumstances of the case is the following:—Mr. Mallet, in a report addressed to the British Association some years ago, showed that wrought iron and steel (blister steel probably), "consist of two or more different chemical compounds, coherent and interlaced, of which one is electro negative to the other." In fact ordinary wrought iron, being also welded up from differently worked scrap, is far from being an electro-homogeneous body. In a boiler, the hot water, more or less saturated with chemical compounds, is the exciting liquid, and the electro-positive portions of the plates are thus quickly removed to a greater or less depth. This explanation meets most of the known circumstances with respect to pitting; it even, in a great measure, explains how plates above the level of the water, especially in marine boilers, get very rapidly corroded in portions, while another part of perhaps the same plate is scarcely affected. The concentrated water in a marine boiler is known to be generally acid. "Of all the salts contained in sea water," says Faraday,* "the chloride of magnesium is that which acts most powerfully" on the plates. He shows that a cubic foot of sea-water contains 3·28 oz. of this salt; and, at the same time, points to the danger of voltaic action in a boiler through the contact of copper and iron. In a smaller degree the contact of cast with wrought iron, or between the different makes of wrought iron in the same plate, or between contiguous plates, acts in the same way. It is not improbable that some hydrochloric acid is present in the steam of marine boilers. "Mr. J. C. Forster† has tested some of the condensed steam from the safety-valve casing, and from the cylinder-jacket of the Lancefield, and found both decidedly acid."‡ With an exciting liquid in the condensed steam, it is thus explicable how the plates of marine boilers often get corroded in a most capricious manner; while, at the same time, the current of steam would create a certain amonnt of friction on the oxide, clearing it away to act on a fresh surface.

The crucial test of this explanation of pitting would be the observation of the absence of the phenomenon from plates of an electro-homogeneous character. This homogeneity could only be expected from fused metal, such as cast-steel. Accordingly, while the writer was in Vienna a short time ago, he was assured by Mr. Haswell, the manager of the Staatsbahn Locomotive Works, that some locomotives made of cast steel plates in 1859, for the Austrian Staatsbahn, had been working ever since without showing signs of pitting, though under similar conditions iron plates had severely suffered in this way. Pitting may thus be fairly defined as a form of corrosion localised to particular spots by voltaic action. It is also probably aggravated through the motion of the plate by mechanical action, and the expansions and contractions through alternations of temperature. All boilers are most pitted near the inlet for the feed water, and with inside cylinder locomotive boilers there is generally more pitting at the smoke-box end—no doubt caused by the more or less racking action on these plates. A state of corrosion at particular spots would probably be kept up to a greater intensity by the incrustation being mechanically thrown off. With a quicker voltaic action, caused by any unusual intensity of the exciting liquid, the sides of the cavities in the plates would be sharper and less rounded off; as in the case of the boiler fed with mineral water from ironstone workings, which exploded last year at Aberaman, South Wales. (See Fig. 5.)

The fact that pitting occurs in marine boilers when distilled water from surface condensers is used, does not affect this explanation. Water distilled in this way, from whatever cause, after repeated boiling, is stated to carry the salinometer even higher than sea water, thus proving that it is not pure.§ In the next, there is the absence of incrustation, which to some extent always protects the plates of boilers from the chemical action of its contents. In this way the mechanical buckling of the plates,—directly and indirectly causing the furrows we have spoken of—by continually clearing particular lines of surface from incrustation and oxide, reduces these particular spots, with respect to corrosion, to the condition of the plates of a boiler fed with water which deposits no incrustation. Corrosion will also

* Fifth Report of the Committee of the House of Commons concerning the Holyhead Roads, p. 194.

† Institution of Engineers in Scotland, 1864—5. Introductory address by Mr. J. R. Napier.

‡ When a solution of chloride of magnesium is evaporated nearly to dryness, the salt and the water are decomposed, magnesia and free hydrochloric acid being formed; or $MgCl + HO = MgO + HCl$.

§ Institution of Mechanical Engineers, 1863. Discussion on Mr. James Jack's paper "On the Effects of Surface Condensers on Steam Boilers."

Fig. 5.

(From a photograph of surface of corroded plate cut from one of the two boilers that exploded on Wednesday, February 17th, 1864, at Aberaman Iron Works, Aberdare. The corrosion was internal, and in some parts the plate was not more than one-eighth thick. Thirteen persons were killed, and many others seriously injured.)

act more rapidly at a furrow through mere increase and renewal of surface. To resist that form of internal corrosion specially known under the name of pitting, a maximum of electro-homogeneity is evidently required in all the component parts of the boiler.

While the action of internal corrosion, often very equally corrugating the plates over a large surface, as a rule scarcely, at any rate only gradually, affects their mechanical strength, external corrosion, being localised to particular spots, is of a much more dangerous character. The one is gradual and easily perceptible, while the other is rapid and insidious in its progress. Apart from accidental circumstances affecting the brickwork on which a stationary boiler is erected, or the outside of the bottoms of marine boilers, it is clear that external corrosion can only occur through leakage. When leakage takes place through a crack in the plate caused by mechanical action, or at a hole burnt out by heat, the effects of leakage are only secondary results, due to a primary cause which of itself may cause the stoppage of the steam generator. But a leakage at a joint may in itself gradually cause the destruction of the boiler. Here we see another reason that the character of a boiler, not merely as to ultimate strength, but also as to wear and tear, intimately depends upon the form of its joints. It is often noticeable that very good lap joints, even when tested under hydraulic pressure up to only 50 per cent. above the working load, sweat more or less. The tendency of the internal pressure to form a correct circle bears indirectly on these joints, causing them to open, more or less, and to leak, in spite of the caulking. Mr. Robert Galloway, C.E., who, as an Engineer Surveyor of long standing of the Board of Trade, has probably made more than three thousand careful inspections of marine boilers, states that he has often noticed a furrow or channel on the outside of the joint, running parallel to the outside overlap for some distance, and evidently caused by leakage. Along the water line, condensed water will act on the joints, while below it the concentrated contents of the boiler will come into chemical action

A leakage in a marine boiler often eats away a plate within a year. In some cases a jet of hot water from a leakage has a frictional action; in fact, even with such an incorrodible and hard substance as glass an effect like this has been perceived, and a slight leakage continued during several days sometimes produces a noticeable furrow on a glass-gauge tube. With sulphurous fuel, a powerful chemical-action will come into play on the plates. One volume of water takes up about thirty volumes of sulphurous acid gas; and these sulphurous fumes of the fuel, coming into contact with the water from a leakage, will be more or less absorbed. An acid solution like this must quickly eat away the plate. It is certain that a leakage acts much quicker on a boiler fired with sulphurous fuel than on one fired with wood. M. G. Adolphe Hirn has observed a plate, nearly seven-eighths thick, to be pierced, in the course of time, as with a drill, by means of a little jet which struck it after passing through a current of hot coal smoke.*

Legislative Enactments.

No stronger proof can be adduced of the empirical state of existing knowledge of the management of boilers than that afforded by a consideration of their average duration. While some marine boilers last only about three years, there are carefully worked land boilers which have lasted as long as thirty. Captain Tyler, R.E., estimates the average duration of a locomotive boiler at from five to twenty years. Perhaps the average duration of a marine boiler may be reckoned at from five to seven years; that of a locomotive boiler at from eight to nine years; that of a stationary boiler at from eighteen to twenty years—all being supposed to be fairly worked under ordinary conditions.

It is clear that, subjected as a steam boiler is to so many destructive influences, the precise effects of which can scarcely be yet very accurately known, the working tension should be only one-eighth of the ultimate bursting strength. But when boilers, as is too often the case in England, are bought by the weight; when cheaply paid labour is employed in their management; when inspection of the progress of the wear and tear necessarily happening even with good boilers and good attendance, is procrastinated for the sake of gain, there is then a suit of expense versus risk, in which parsimony too often gains the day. At any rate, a number of painful accidents in all parts of the world have, at different times, pointed to the fact, that every man picked at hap-hazard cannot be safely trusted with steam-power. In fact, there is probably no civilised country in which the legislature has not more or less interfered in the management of steam boilers. In the States of America, the frequency of boiler explosions has in some localities produced a more despotic interference than perhaps anywhere else. In the city of New York, boilers are under the supervision of the municipal police; they are tested periodically; and, as a result, many are condemned every year. By an enactment of Congress, applicable to all the States,† steam passenger vessels are subjected to Government inspection. The 13th section of this Act shows a very acute perception of the real cause of a boiler explosion, "which," it states, "shall be taken as full *primâ facie* evidence" of negligence on the part of the owner, upon whom is thus put the onus of disproof. The law of Louisiana‡ is particularly severe, requiring the application of a hydraulic test threefold that of the working pressure. Of course, there is a great distinction between enacting a law and putting it into practical execution, and it is probable that laws like these could only be carried out by organised bodies of police, like those on the continent. In France, in 1810, 1825, 1828, 1829, 1830, 1843, and

* Bulletin de la Société Industrielle de Mulhouse, 1861, p. 558.

† Session of Congress, July 7, 1838.

‡ Baltimore American, 1835.

lastly on the 25th of January, 1865, as many different regulations have been issued with respect to steam boilers of all kinds. Beginning by requiring that every boiler, even of wrought iron, should be submitted to a hydraulic test of five times the working pressure, this has been successively lowered down to a threefold pressure in 1843, and lastly to a twofold pressure, by the Imperial decree of this year.* The previous law fixed the minimum thickness of the plates—a regulation which undoubtedly did much injury to boiler making in France. The old Prussian regulation of the 6th of May, 1838, also fixed the thicknesses of the plates, but did not require any hydraulic test. By the *Regulativ*† of the 31st of August, 1861, this was completely altered. The construction of the boiler was left entirely in the hands of the maker; but stationary boilers had to withstand a threefold, and locomotive boilers a twofold, hydraulic pressure. In the same way as with the present French law, the test had to be repeated after any considerable repairs. On the 5th of March, 1863, a ministerial decree reduced the testing pressure for old locomotive boilers down to 1½ of the working pressure; and another *Circular Erlass*, published on the 1st of December, 1864, reduced the test for all kinds of boilers down to twice the working load. There is now no material difference between the French and the Prussian regulations respecting boilers; and it may be expected that those continental states, such as Russia, Switzerland, and Spain, which have more or less copied the old French law of 1843, will also adopt the present alterations. There is also some talk about altering the present Austrian law,‡ which determines the thickness of the plates, but only demands a double pressure test. The Belgian *réglement* § also requires double the working pressure for common boilers, but only 1½ for tubular boilers. According to Article 31, the test must be annually applied to locomotive, portable, and marine boilers, as also after all considerable repairs. There does not seem to be any general law in Italy, but in the special acts authorizing railway companies, similar requirements to the French regulations are laid down, and government commissioners see that they are carried out. Each of the smaller German states also has its law, more or less like that of France and Prussia. Mecklenburg-Strelitz‖ requires that common boilers be proved to three, and tubular boilers to twice the working pressure; to be renewed every fourth year, and every time that the boiler is repaired or altered; Saxony,¶ that cylindrical boilers be tried to twice the working pressure, and tubular boilers to a pressure three atmospheres above it. Bavaria** now requires double the working power pressure for new, and one and a half for old boilers; while both Hanover and Brunswick each have a somewhat similar regulation.†† The French law, and indeed most of the others, require two safety valves; and many are extremely minute in their directions with respect to glass gauges, steam gauges, and other fittings. In Great Britain there are no express legislative enactments with respect to boilers beyond those stated in two clauses of the Merchant Shipping Act, ‡‡ according to which (1) one safety-valve in every boiler of a vessel carrying passengers shall be placed beyond the control of the engine-driver; and (2) any overloading of this valve is made punishable by a fine of not more than £100, "in addition to any other liabilities" which may be incurred by such an act. The boilers of all vessels carrying passengers, before clearing out of port, are subjected to a careful inspection by an engineer-surveyor of the Board of Trade, who can require the boiler to be tested in the usual way to twice the working pressure; and, if he think fit, he can, as the result of such an examination, place the option before the shipowner of either lowering the working pressure or renewing the boiler. Armed with such powers, the government surveyor is also responsible for any explosion which may directly occur through wear and tear. When an explosion takes place on a passenger railway, one of the Board of Trade inspectors of railways examines the fragments and reports upon the accident to the government board, who communicate it to the railway board. The reports are then printed, in order to be presented to Parliament, and this is the extent to which the British government can interfere in these cases. As with other railway accidents, however, the Board of Trade inspector is examined as a witness in any action for damages against the railway company. All other boilers in the United Kingdom are worked without any government or municipal interference whatsoever. Within late years, however, private companies (the first of which was organised by Mr. Fairbairn, of Manchester) have been formed for the prevention of boiler explosions. In return for a small annual fee, or for a small annual insurance premium, the boilers of any subscriber or insurer are periodically inspected, and, if required, tested by skilled engineers. There can be no doubt that these companies have already prevented a great amount of loss and disaster.

It may thus be said that there are three distinct plans for the general management of steam boilers:—1. There is the continental plan; 2. the free English and American mode; 3. what may be termed the Manchester system. The continental mode consists in a strict supervision, sometimes ruled by formulæ, of the original construction, and there its action may be said, for the most part, to end. It does not, and cannot, without periodical inspections, take into account the effects of wear and tear. It may even be doubted whether the old French law, for instance, did not do more harm than good as regards construction. The official formula, according to which were calculated the thicknesses of the plates, founded as it was upon the assumptions that a cylindrical boiler formed an exact circle, and that a plate, however thick, conducted the same amount of heat to the water, was obviously incorrect. What may be termed the ordinary English and American plan throws the onus of proof of the negligence of the owner on those damaged by an explosion. This system is subject, besides other difficulties, to all the objections that exist against the trial of scientific questions by a jury, not composed of experts, and unaided by scientific witnesses. The continual occurrence of explosions in those cities and States of America in which boilers are used without any supervision by the authorities, and their undue occurrence in England with boilers that are not subjected to systematic inspection, sufficiently prove that steam boilers cannot be worked at hap-hazard. On the other hand, the system of organised inspection by the English boiler companies, and the similar system according to which the passenger vessels are inspected by government officers, have given universal satisfaction. A proper estimate of the value of the Manchester and Board of Trade system, compared with the continental and with the *laisser faire* plans could only be well based on numerous statistics. Unfortunately, such do not appear to have been formed. It is stated,* however, that in a average of 277 boilers, there were two explosions in the French department of the Haut-Rhin within ten years; and,

* Décret concernant la Fabrication et l'Etablissement des Machines à Vapeur. 25 Janvier, 1865.

† Düsseldorfer Zeitung. 24 ste September, 1861.

‡ Reichs-Gesetz-Blatt fuer das Kaiserthum Oesterreich, 1854; p. 229.

§ Ministère des Travaux Publics, Machines à Vapeur.—Règlement. Donné à Laeken le 21 Avril, 1864.

‖ Grossherzoglich Mecklenburg-Strelitzer Offizieller Anzeiger, No. 11, 1863.

¶ Gesetzliche Verordnungen, die Anlegung von Dampkesseln betreffend. Dresden, Meinhold und Sœhne, 1865.

** Regierungs-Blatt fuer das Kœnigreich Bayern, 22 Februar, 1865.

†† Gesetz-Sammlung fuer das Kœnigreich Hannover, 1863.

‡‡ Merchant Shipping Act, 27th June, 1854, Nos. 289 and 298.

* Bulletin de la Société Industrielle de Mulhouse, 1861, p. 525.

from 1856 to 1861, or within five years, there were only two explosions in an average of 1371 boilers, under the care of the Manchester Association. About four explosions occur annually amongst the 6,500 locomotives of the United Kingdom; three have already taken place this year. In an average of 600 passenger vessels inspected under the Steam Shipping Acts, only three explosions occurred since 1846-7 in Great Britain; viz: one at Lowestoff, in the *Tonning;* another at Southampton, in the *Parana;* and a third at Dublin. These last results speak very highly for the care and abilities of the Engineer Surveyors of the Marine Department; and the continental system is thus clearly inferior to that adopted by the Board of Trade. What is evidently wanted is that the system of skilled periodical inspection should spread over the kingdom. To a certain extent this is taking place, but this progress is slow, and needs some stimulus, while it is doubtful whether, in out of the way districts, the mere expense of inspection is not a great bar. What seems to be needed is that in the event of a fatal explosion the coroner of the district should be enabled to write to the Home Office for scientific assistance in arriving at the originating cause. The Secretary of State might then call upon any competent engineer for a report on the matter, when he could be examined as a witness before the jury. The mere knowledge that any explosion would be strictly investigated by an expert, might, in many cases, be sufficient to counterbalance the too prevalent tendency to prefer risk to expense.

The Hydraulic Test.

Although, as we have seen, the application of a known amount of hydraulic pressure is in such general use for the determination of the strength of a boiler, there are, nevertheless, few points in engineering about the real value of which there is so much dispute. Everybody seems to have a different opinion on the matter. Some say that the hydraulic test is the only means of determining the strength of a boiler; others that it is a very injurious and useless measure. As to its amount, some recommend one-and-a-half, many twice, some thrice, and a few even four times, the working pressure. While numerous engineers advise its application to old boilers, others have strong objections to its use in this way. Whether the force-pump be really the best apparatus for its application, is, with other questions, also placed in doubt. The truth is that, while on the one hand, like other tests, it may be abused and wrongly applied, on the other its value may also be exaggerated.

The best practical proof of its necessity for new boilers is afforded by the fact that explosions have occurred the first time steam has been got up—such as that at the Atlas Works, Manchester, in 1858. Unless every plate be separately tested up to proof load, it is impossible to be certain whether one of them is not defective. This function is clearly much better performed by the hydraulic test. Then, as to its application to old boilers, much can be learnt during internal examination, but it is not always possible to tell the remaining thickness of the plates by this means, nor their deterioration through the heat. It is often said that a successful resistance to the hydraulic test is no proof that the boiler might not have been burst by a few pounds more; and that it may so suffer as to perhaps afterwards burst with a less pressure of steam. But this is no more true than it is true of a girder, for instance, which has withstood without permanent deflection its proof load. In every case it is necessary that its effects on the boiler should be exactly ascertained. In fact, the real test consists in this examination, and the proof pressure is only a means to this end. The boiler should, if possible, be subjected to a careful internal and external examination. With locomotives this can only be accomplished by taking out the tubes; with ordinary land boilers it can only be done by removing the brickwork. In fact, it may be said that a steam boiler is never absolutely safe which cannot be easily examined—more especially from the inside. But by gauging the flue tubes, the combustion chambers, the flat surfaces, and even the barrels, it may be ascertained very nearly whether the limits of elasticity of the material have been exceeded—whether therefore the pressure has additionally injured a boiler which was near rupture already. It is often very plausibly observed that there is great danger in testing a boiler, which cannot be examined internally, to double, or even to only one and a half the working pressure. It is said that the test may strain the boiler without its showing any outward indication. It is certainly just possible that such a case might happen. A locomotive boiler, which had been tested with 196lbs. pressure, the water being at 162° F., in September, 1860, but had not been examined internally, burst on the 1st of April, 1861,* under only 120lbs. of steam. The boiler gave way at the smoke-box ring of the barrel, and, as usual, from a furrow or crack running close to and parallel with the inside overlap of the longitudinal joint. It is difficult to believe that if this ring, as well as the others, had been gauged after stripping the lagging from the outside, as is done by the engineers of the Manchester Boiler Association, it would not have shown a permanent increase of diameter or some bulging under the extra pressure. If, in addition to a neglect of careful measurements before and after the application of the pressure, this test is carried very high, then the whole operation may undoubtedly be a cause of that which it is intended to prevent. According to the Prussian law, every new locomotive boiler had to be re-tested to double the working pressure after running 8,000 Prussian miles, and afterwards for each 5,400 miles. These measures, while they did not entirely prevent explosions, greatly injured the boilers, by straining the staybolts, and by the resulting excessive caulking required to make the joints tight. On the other hand, the absolute security afforded by drawing the tubes can, under the present mode of construction, be only obtained at the expense of, perhaps, 300 tubes, costing from 25s. to 27s. each, besides some injury to the tube plates.

Whatever may be said against the hydraulic test, the best argument in its favour is its very general adoption. New Government boilers in the United States must be tried to a pressure two-thirds greater than the working pressure; the same measure being carried out with the 3,000 boilers in the city of New York. Mr. Anderson, C.E., of Woolwich,† directs his subordinates to use a test of at least double the working pressure for the boilers in the royal gun factories. Mr. Muntz, of Birmingham, has publicly stated that he has for years adopted an annual hydraulic test, "considering it a duty he owes to his workmen." The Eastern Counties, the South Eastern, the Lancashire and Yorkshire, the Caledonian, the North British, the Edinburgh and Glasgow, and the London and South Western Railway Companies employ the hydraulic test for both new and old boilers, using generally double the working pressure. The London and North Western are stated to have used it for only new boilers—at any rate, until recently. The Great Northern and the Great Western Railway Companies do not use it, and it is accordingly on on these lines that the greater number of explosions take place. Practical experience thus proves that, though there is just a chance of the test failing to detect a weak boiler when it cannot be examined internally, the danger is greater in not using the hydraulic test at all. Mr. Beattie, of the London and South Western, strips the lagging every two years, and applies a pressure of 190 lbs., the working pressure being 125 lbs. Mr. Fletcher, of the Manchester Boiler Association, employs double the intended working pressure for new, and from $1\frac{1}{2}$ to $1\frac{3}{4}$ the working pressure with old, boilers. The most commonly

* Board of Trade Report. 1861. Part 4.

† "Instructions to be Observed in the Management of Steam Boilers in the Royal Gun Factories."

used test is thus double the working pressure for old boilers, with a diminution according to circumstances as they get old.

An objectionable plan in measuring the pressure applied, and, for several reasons, one likely to lead into error, is estimating it from the load on the safety valve lever. A metallic gauge should be used, and very neat pocket instruments of the kind are sold in Paris. In frosty weather the rivet heads are liable to be snapped if the metal be not somewhat warmed by using hot water. The hydraulic ram kind of action on the sides is also much less likely to occur if a rather narrow force pipe be used for the pump.

There can be no doubt that it would be a valuable thing to be able to employ some means of measuring the permanent and the temporary extension of volume, if any, produced by the hydraulic test. It is probable that a boiler, as it gets old, and takes a permanent set under the pressure, also increases in volume; so that it doubtless holds a few gallons more that it did when new. An ingenious plan for measuring the increase of volume is recommended in the Bavarian regulation. After the boiler is filled, the amount of water forced in is measured by pumping it from a vessel marked with divisions. When the pressure is removed the boiler contracts more or less, forcing out at least a portion of the water; the amount remaining is supposed to give the dilatation of volume of the boiler. The difficulty in the use of this plan would probably consist in the presence of air in the water itself, and any which might chance to remain in the boiler. That in the water might be greatly diminished, or at any rate brought down to a constant amount, by boiling; but there would be no precise security against any air in the boiler, and as the weight of the air absorbed by water (according to a well-known law) is in proportion to the pressure, it would be taken up by the water, thus falsifying the indications when the pressure was removed. On the other hand, a high temperature of the water would form an impediment to this absorption. The experiment is certainly worth trying. It might be very valuable with tubular boilers inaccessible from the inside, as any permanent set or deflection ought to be indicated by little or no water being compressed out by the contraction of the boiler on the removal of the pressure. As long ago as 1844, M. Jobard, of Brussels, in order to obviate the supposed injurious effects of the hydraulic blow of the water on the plates, proposed to fill the boiler with water, first loading the safety valves, and to then dilate the water, and consequently the boiler, by means of heat applied to the outside.* More recently, Dr. Joule, of Manchester, has used the same plan himself, proposing it for general adoption.† In addition to the loaded safety valve, he used a metallic pressure gauge "to be constantly observed, and if the pressure arising from the expansion of the water goes on increasing continuously without sudden decrease or stoppage until the testing pressure is obtained, it may be inferred that the boiler has sustained it without having suffered strain." Another plan, also founded upon the same principle of the irregularities of extension of metals when the limit of elasticity is exceeded, has lately been proposed.‡ This consists in bringing an ordinary steam-engine indicator in communication with the pump plunger as if it were a steam-engine piston-rod. The ordinates of the pencil diagram would thus give the pressure in the boiler, while the respective abscissæ would give the quantity of water pumped in at each stroke. As long as the limit of elasticity was not exceeded there would be a horizontal line, while a curved line would appear as soon as the sides began to take a permanent deflection. There seems to be a sort of contradiction in depending for results like these upon such irregular appearances as the extensions beyond the elastic limit. But all these proposals are undoubtedly worth trial in practice. Dr. Joule's plan has the merit of affecting the plates by both heat and pressure—thus bringing them under every-day conditions.

* "Technologiste," 1844, p. 135.

† "On a Method of Testing the Strength of Boilers." Journal of the Manchester Philosophical Society, 1862, p. 97.

‡ Polytechnisches Centralblatt, p. 1,337, 13 October, 1864.

DISCUSSION.

Mr. Lewis Olrick said there were some points in the paper with which he did not agree. It was stated by Mr. Paget that one cause of injury to steam boilers was the percussive action of the steam when suddenly cut off by the slide valve, which caused a recoil upon the sides of the boiler. On this point he would remark that, in the great majority of boilers used in England, the slide valve did not suddenly cut off the steam; in most cases the slide valve was moved by an eccentric, and the cutting off was gradual, and not sudden, as in the case of the American engines; and this remark, therefore, only applied to those engines where the expansion gear acted suddenly. Allusion had been made to the straining of the cylinder covers. He had seen such cases, and he had also observed the foundation-plate give at each stroke of the engine; but he had no doubt, if Mr. Paget had examined the plates in such cases, he would have found that this was not caused by the percussive action of the steam, but was owing to an insufficient amount of metal and insufficient strength put into the proper place. He had noticed this in the case of an engine of 20 horse-power, which had been in use for many years in the factory of Messrs. Maudslay, where there was an insufficiency of metal in the proper place. He had never seen it where the cylinder covers were strong enough for the work they were expected to do. Another point mentioned by Mr. Paget was, that the steam room in the boiler should be proportionate to the size of the cylinder; he should have been glad if Mr. Paget had stated what he considered to be the proper proportions. Reference had been made to the caulking of boilers under pressure. This might be done when a boiler was tried by the hydraulic test, but the proper way was to take off the pressure, and then caulk and put on the pressure again. It was only the question of a minute to pump the pressure up again, and a few strokes more gave the additional pressure, beyond the former one indicated by the chalk mark. The next point he would allude to was with regard to the feed water. In would appear that many engineers did not consider it wrong to insert the feed water pipe near the fire box. Quite recently he had seen that done in the case of a locomotive, in which a Giffard's injector was employed; and he would call the attention of those who had not considered the subject to the explanations which Mr. Paget had given as to the injurious action of the feed water on the boiler plates. The next point in the paper had reference to the superior heat-conducting power of thin boiler plates as compared with thick. This was no doubt the case, but in speaking of the American plates, Mr. Paget had omitted to mention the superior quality of those plates, which made it possible to use them of a thickness which would not be ventured upon in England. Within the last few years the quality of the best plates in this country had almost come up to the American standard, but those generally used were not so good. Allusion had been made to the voltaic action that took place in steam boilers, and the evils that might follow from it. Some years ago a pamphlet was published by Mr. Zerah Colburn, in which the action of steam-boiler explosions was explained, and the question of the galvanic action was based upon the high authority of Professor Faraday, to which he (Mr. Olrick) would willingly bow. He entirely agreed with the general remarks in the paper with respect to explosions. They involved the sacrifice of a great amount of life and property, and he thought it would be desirable for the Government to take this matter in hand, and to in-

troduce stringent rules to make people more careful with their boilers. The greatest amount of mischief was occasioned by employing men to attend to boilers who knew nothing whatever of the properties of the steam-engine. It was a question which could not be too much impressed upon people, that there should be proper periodical inspections of boilers, according to the system adopted by the Manchester Association. Mr. Paget had mentioned the hydraulic test. There was a great difference of opinion amongst engineers on that question, but no doubt, as Mr. Paget had pointed out, practical experience led to the conclusion that in all cases where this test was carefully applied there were much fewer explosions than where it was neglected. The cases of locomotive engine explosions had occurred solely on lines where that test was not employed. On the subject of the wear and tear of steam boilers he would remark that the great cause was defined by the single word "neglect," often on the part of the designer and manufacturer. When a boiler was made too small there must be forced firing, and the consequence of that was early destruction of the boiler. A further deteriorating cause was defective circulation, producing similar consequences. There was one point which it was almost unnecessary to mention, viz., that if boilers were not properly stayed they would give way earlier than if proper attention was paid to the staying. But the great evil arose after the boilers came into the hands of the owners, from employing unskilled persons to work them. The amount saved in wages in this respect was an injudicious economy, and it was a question whether parties who confided boilers to such people ought not to be made responsible in a court of justice in the event of explosions taking place. Amongst the various evils to which steam boilers were exposed there was none worse than bad feed water, which was a frequent cause of their destruction. A most grievous evil was scale in the boiler, which lowered the heating power, and thus it was most important that it should be frequently removed. Scaling arose from bad water, but as rain water was not generally to be procured, they had to be satisfied with well water, which was generally very hard, and which led to large deposits of sulphate of lime in the boiler. For the removal of the carbonate of lime from the feed water, he believed Dr. Clark's process was very effective, though the means by which the result was accomplished would appear strange to those unacquainted with the subject. Lime was added in excess, which caused the precipitation of the salts of lime already in solution, and thus the water was purified.* There was also another plan, which had been successful in preventing scale, known as Martin's invention, which he had no doubt was also efficient. In that plan the feed water was made to pass through a cylinder containing plates arranged diagonally and filled with superheated steam; the water deposited its scale upon these plates before entering the boiler. The consequence of this was a clean boiler instead of the accumulation of scale. The usual way of removing scale was sending boys with hammers into the boilers and knocking it off, which often caused great injury to the structure of the boiler, from carelessness in the operation. He was sure they must all feel indebted to Mr. Paget for his valuable and exhaustive paper.

Mr. Stenson remarked that mention was made in the paper of the circumstance of the stay bars in boilers being in a crystalline state, and only requiring a slight blow of a hammer to break them. He had heard papers read before this and other societies in which this question had been debated, but there was one point which required first to be settled—viz., the real condition of the iron previous to its being made into stays. Was it crystalline before it was so used? or had it become so by use? He had been connected with engineering the greater part of his life, and he must say he had never met with an instance in which it was satisfactorily proved that the iron had been converted from its fibrous condition before use. It was asserted that percussive action tended to produce a crystalline condition of the iron. This might be so, but he required further proof of it. He had cut up and examined a great many piston-rods and connecting-rods of locomotive engines working at great velocity; he had found them to be in various states—some partly crystalline and some entirely so, while others had remained fibrous throughout; and he had found the same characteristics of inequality in the tires of railway wheels. The leakage of boilers had been referred to in the paper, and he held it to be a very important subject for investigation. He knew, from experience with boilers in his own use, that a very small leakage would destroy the plate from the outside. The oxydation commenced at the spot, not where the water leaked, but where it evaporated and the plate was dry. The destruction of the plate from this cause was so rapid that he had known a $\frac{3}{8}$-inch plate cut through by a small leakage in a few months after the boiler was put up. He had no doubt this was caused by the chemical action of the water upon the plate. With regard to scale, Mr. Olrick had mentioned a plan which he regarded as efficient in preventing the usual effects of the deposition of carbonate and other salts of lime in steam boilers. There could be no doubt of the destructive effects of those deposits upon the plates of the boiler, as also of the retardation thus caused to the heat. He should be glad to hear some further explanation of Mr. Martin's process, as he regarded scale as the greatest element of destruction with which they had to contend in the working of steam boilers.

Mr. Adams, whilst agreeing to a great extent with what had been stated in the paper, took exception to the remark that the method of welding plates reduced their strength. He had seen many successful experiments in welding, by Bertram's process, at Woolwich, and it was invariably found, under ordinary circumstances, that the weld was the strongest part of the plate, for it was a well-known fact that a piece of iron forged after it came from the rollers was stronger than when it left the rollers. Mr. Paget had quoted from some German authorities respecting the temperature at which water was decomposed, but he would state a practical fact within his own experience. On one occasion the steam was allowed to stand stagnant in a superheater for ten days, and on the tenth day the metal of the superheater ran away into the fire, but no decomposition of the water had taken place. With regard to the hydraulic testing of boilers, engineers were not agreed as to whether the testing should be made at a high temperature or not. They knew, in testing a boiler cold, they had the friction of the rivets; but in hot testing the expansion of the metal by heat caused a great difference. The rivets expanded to a greater extent than the plate itself, because the expansion of the rivets was longitudinal and along the fibre, whereas the expansion of the plate was across the fibre and not so great, and the power which the friction of the rivets gave to the strength of the plate would be less when cold; but to oppose that there was the greater strength of the plate due to the low temperature. Mr. Adams then, by means of a diagram, described in detail Martin's process for preventing incrustation in boilers.

Mr. G. F. Wilson, F.R.S., on the subject mentioned in the paper as to water or steam in contact with iron being decomposed, would give an instance in his own experience where such was not the case at a very high temperature. It had come under his observation that steam passing day by day through iron pipes at a red heat was not decomposed, or there was no evidence of its decomposition. The theory was that hydrogen ought to have been formed and an explosive mixture should have been generated, but practically such explosive compound was not formed.

Mr. Olrick wished to add, with reference to the hydraulic testing of boilers, that he had in many in-

* *Journal of the Society of Arts*, vol. iv., p. 424.

stances used hot water for the test up to 200 degrees, as by that means the boiler was brought into a very similar state to what it would be in when at full work.

The Chairman said it now became his duty to move that the thanks of the meeting be given to Mr. Paget for the paper with which he had favoured them. It was very comprehensive in its scope, and he thought contained many valuable suggestions. No doubt public safety was of the first importance in matters of this kind, and the mode in which that could be best obtained seemed to be practically indicated by the inspections undertaken by the Manchester Society. Other means no doubt might be taken for ensuring the safety of the public; but there was no plan so effective as when the public took care of itself, as was the case at Manchester. With regard to the economy of wear and tear, it was a question for engineers, and one upon which he could not venture to give an opinion; but, undoubtedly, it was an important question for those who employed steam boilers in their manufactories in which a large amount of capital was invested. They must all feel indebted to Mr. Paget for his careful investigation of the subject, and the able manner in which he had treated it in his paper.

The vote of thanks having been passed,

Mr. Paget, in acknowledging the compliment, said that a perusal of his paper would show that he had very carefully guarded himself from stating that any impulsive action on the sides of the boiler could be brought to bear by means of the gradual action of the side-valve. In speaking of the effect of galvanism on steam boilers, he of course only meant the chemical action on the plates producing wear and tear, and therefore the primary ruptures leading to explosions. With respect to incrustations, he thought that the effects they produced were simply those which ensued whenever a plate got red hot. In speaking of the charcoal plates used in America, he was necessarily aware of their superiority to iron made with pit-coal. Testing boilers by means of hot water instead of cold, was often, as he stated, very advantageous, and, indeed, necessary. With regard to the crystallization of iron, and with respect to Mr. Stenson's remarks, he thought that this state was simply due to strains in excess of the elastic limit, abstracting elasticity and ductility, and therefore inducing brittleness. The crystallized appearance of a surface of fracture was simply due to the mode of fracture. His observations with regard to Bertram's joints were founded on the results of experiments conducted at Woolwich for the Admiralty. With respect to boiler insurance companies, their action undoubtedly offered the best means of safety and economy; at the same time, their future spread needed some extraneous stimulus, more especially in sparsely populated districts, like the agricultural and some of the mining counties.

DUBLIN INTERNATIONAL EXHIBITION.

The Natal Court attracted great attraction at the Exhibition in 1862, from its wild and picturesque objects of native industry and sports of the chase, and it will be equally well represented at Dublin this year. From an interesting local account, the following particulars are taken:—

First comes the interesting collection so opportunely contributed by Mr. Barry. That gentleman has recently returned from his long and devious trip across the continent, and some of the curiosities which he has gathered together during his journeyings are new and rare. These articles are very illustrative of domestic life among the Bechuana tribes of the interior, and especially so of the people living around Lake Ngami. We doubt whether such a gigantic pair of bullock horns has ever been submitted to British eyes as that presented to Mr. Barry by Lechulatabe, Chief of the Batoana. They are certainly second only to the monster pair in the first International Exhibition. Several pairs of rare buckhorns are also contributed by Mr. Gifford, Mr. Baker, and Mr. Topham. The gemsbok horns, lent by the first of these gentlemen, are, from their size, very interesting. To the same class belong the skins of various antelopes and animals. The poisoned arrows belonged to Bushmen, and are made of dwarf reeds pointed with bone spines, thickly covered with the deadly poison obtained from a small beetle which infests a tree of the mimosa tribe. The are sticks found in the same sheath as the arrows are the roughest mode of ignition known. The upper stick has to be twisted in its charred socket for about ten minutes, before the sparks are created. Some caps and head-dresses, made of feathers and skins and worn by the Bechuanas near the Great Lake, show how the barbaric ideas of costume advance as we go northward. They are principally worn on frosty nights—for in the winter months of the mid-year the cold around the marshy borders of the lake is severe. Among other domestic accessories picked up by Mr. Barry are some rattles, made of large seed pods; a fan, formed from the tails of golden jackals, and which are also used for the purposes to which pocket-handkerchiefs are generally applied; some spoons and ladles, cunningly carved in twisted shapes, from solid pieces of wood. There are also some articles in this part of the collection valuable in a commercial sense. The fibres are very fully represented, both in their raw state and in various kinds of twine, cord, and thick rope, made and used by the natives round the Botlellie river. These fibres are mostly obtained from different varieties of marsh grass, and the rope exhibited has been employed in the trapping of elephants and the capture of hippopotami. A hundred yards of very strong fishing netting, as used in the waters of Ngami, show how large and valuable are the fibre resources of all Southern Africa. The tribe from which these specimens were got is the Bajeye or Bakoba. Reference should be made to the large earthenware jars, which, as superior specimens of native pottery, well deserve inspection. In this lot will be found a war knife, with an oddly-carved shaft. This comes from a tribe living to the south of the Zambesi, and never yet visited by a white man. Perhaps the most grotesque object is the rudely carved elephant, a primitive specimen of sculpture. These are the principal items in Mr. Barry's contribution, which is likely to be the best assortment of African curiosities in the Exhibition.

There are, however, other more local representatives of native industry. Mr. Topham's valuable collection comprises the entire range of Zulu Kafir economy. The hard, grim looking logs of stained wood are the pillow and stools which form almost the only furniture in the native's hive-like hut. The little snuff-spoons, with their long prongs for insertion into the woolly wig adorning the manly brows of the savage, are no mere ornament, but, in consort with the snuff-boxes, made out of small gourds and calabashes, are in constant use every hour of the day. Nor is the office of the stone pipe a sinecure. This perhaps represents the most primitive form of narghileh. Seated in a circle, this calumet is passed from hand to hand, until the enchanted smokers subside into a wakeful stupor, caused by the strong fumes of the *dacca* or native hemp, whose smoke is inhaled through the water at the bottom of the cow-horn. Some idea of native aptitudes for mat-making and basket-work will be gathered from the specimens shown. That the natives are not devoid of the artistic faculty, a glance at some pieces of bead-work will show. Since it became compulsory on natives to enter the limits of townships clothed, the demand for beads has not been so great. Fashions regarding them vary very much. Sometimes large red ones will be in vogue, at other times small speckled ones. It is at their kraals, however, on state wedding occasions, that the Zulus may be seen to the greatest advantage in their panoply of beads, feathers, skins, and other savage finery There is also a bundle of Amaxosa assegais, and a very interesting Bushman spade, sent by Col. Maclean. The

ormer are as suggestive in their way as the spears displayed in the Tower, while the last, it must be remembered, is the industrial handiwork of a race which ranks lowest in the scale of humanity. Perhaps, however, the most remarkable of all these native curiosities is the gigantic and very striking piece of wood-carving exhibited by Mr. Horwood, and obtained by him from the native who made it in Zululand. This strange object consists of three graduated central bowls of carved wood, stained black, and diminishing in size as they rise upward. All around them smaller bowls project, and each has its basin-like cap. The height of the whole structure,—for it really deserves that name—is nearly five feet, and its diameter about three feet. It is entirely hewn and cut from one solid block of wood, and it took the maker, who had only a knife to work with, eighteeen months to execute. Its use is to hold beer. Old African travellers say that they have never seen anything at all equal to this extraordinary production.

The most valuable part of the collection is that which illustrates the industrial and commercial resources of the colony itself. But allowance must be made for the hurried nature of the effort. The articles that are exhibited have been hastily got together, and they must by no means be taken as a pattern sample of what Natal can grow. In regard to sugar, which may be looked upon as the staple product, there is a sample of the best yet made in Natal by the ordinary process. It comes from the estate of Mr. H. Shire, on the Umhlanga, and was made in his battery by Mr. Collard, a Mauritian sugar-boiler of great experience. In size and purity of grain, it almost equals sugar made by the vacuum pan process. The vacuum pan sugars from Canonby estate are *sui generis*. No other plantation yet possesses this important appliance. Altogether the array of sugars will be enough to prove that Natal is equal, as a sugar-producing country, to either the Mauritius or the West Indies. Mr. A. Wilkinson's display of rum, rectified spirits, and rum shrub will be a new feature never exhibited before. The spirit is manufactured from the refuse of cane crops, and is fit for chemical purposes or varnish.

Mr. Baker shows samples of wool and angora hair well prepared, and there are also fine samples clipped from the flocks of Mr. Mesham and Mr. Tomline.

The Cotton Company's bales of cotton are better samples than those shown in 1862. Mr. T. Reynolds sends a beautiful parcel of cotton from Oaklands. Mr. Martin's hank of wild cotton twist, from near Delagoa Bay, and the sheet made therefrom, may afford some speculation to those interested in the discovery of new fibres. The very fine samples of flax from Messrs. C. Hunter and Co.'s flax-works ought to attract some notice in Ireland, where this staple gives support to so many people. Mr. Beningfield's aloe and pineapple fibres show to what purpose two plants—one of which is met with wild while the other grows like a weed—can be put. In Mexico, the Indians and the halfcastes dress largely in fabrics made of the agabe. There are hosts of fibres little known to the scientific or industrial world, but very valuable withal, existing in a wild state in this colony and the interior. Dr. Mann's collection of woods is complete so far as it goes, though necessarily not so numerous as in 1862. Mr. Topham also sends some beautifully prepared woods, many of which take a fine polish. No better-flavoured tobacco can be desired than that of Mr. C. Manning. Rich, mild, and fragrant, it is just what a critical smoker would desire. Mr. Hodgkin also sends colonial cigars. Cayenne pepper is abundantly represented from samples from Mr. P. Steel, Mr. J. P. Voysey, and Mr. Russell. All, however, differ in colour and quality. There need be no limit to the local production of this article—the pulverised capsule borne by the chili and capsicum bushes. Arrowroot is only represented by a sample from Mr. Stainbank, the last season's supply having benn all shipped.

Corn is not so fully or fairly represented as could be wished. Messrs. Henderson and Scott's wheat proves however what can be done in that way, and Mr. Baker's oats are equally as significant; but of the great item of maize—the staple corn stuff of the country—there is only one sample. Mr. Topham has also sent a piece of copper, mined and smelted by the natives. Coals have not been overlooked, Mr. Baker having forwarded a box of superior specimens. These will go to show that the Coal Company has something tangible to support its designation. The local smiths never hesitate in giving the preference to colonial over imported coal—the former burns so long, so bright, and so well.

Mr. P. B. Short has contributed luscious and tempting conserves of pine-apple, bananas, and amatungulu. The last-named, being a native fruit, will be new to those who look at it. The syrups made from the same fruit, and from the pineapples, have golden and delicate pink tints that are very pleasant to the eye. The copies of Messrs. Davis and Son's Naval Almanacs are a creditable example of our literary and typographical capabilities; and the maps sent by Dr. Mann will assist the spectator to form an intelligent comprehension of the colony from which these articles have come. Messrs. Brock have promised some of their excellent photographs; but Dr. Mann's photographs of Bishop Colenso's "intelligent Zulu" and his wife, will excite as much interest as any other item on the list.

THE PARIS EXHIBITION OF 1867.

The Belgian Minister of the Interior has addressed the following circular to the governors of the various provinces:—

"M. le Gouverneur,—A Universal Exhibition of the products of agriculture and industry and the fine arts is to open at Paris on the 1st of May, 1867. A Commission, presided over by his Imperial Highness Prince Napoleon, has been charged with its preparation and direction. By request of the French Government, a committee has been now instituted in Belgium to place itself in communication with the Imperial Commission, in order to furnish it with the information it may require respecting our country, and bring before it the wishes of our manufacturers.

"This committee consists of M. Fortamps, Senator, formerly Chairman of the Belgian Committee at the London Universal Exhibition, President; M. Adam, Director-General of Direct Contributions, Customs, and Excise; M. Beliefroid, Director-General of Agriculture and Industry; M. Romberg, Honorary Director-General of Fine Arts; M. Moxhet, Director of the Consulates; M. Kindt, Inspector of Industry, Members; MM. Dulieu and Clerfeyt, Secretaries.

"The committee is authorised to place itself directly in connection with you, as well as with the Chambers of Commerce, Commissions of Agriculture, and other competent bodies, for everything concerning the mission with which it is charged.

"Be kind enough, M. le Gouverneur, to give the committee the assistance it requires to accomplish its task, and to allow it to find the same willing aid among the authorities to which it may have to address itself.

"Everything appears to indicate that the Universal Exhibition of 1867 will have an exceptional importance and brilliancy. The development recent Customs reforms have given to the commercial relations of France and Belgium, already previously considerable, and the extension these relations may still receive for the advantage of the two countries, permit us to suppose that our producers will endeavour to occupy a distinguished place, worthy of their renown, and conformable to their interests.

"In any case, as it is important that we should have a sufficient notion of the amount of space which should be reserved for the products of our fellow-subjects in the Exhibition building it is intended to construct, I request that you will take what you consider the most efficient

means of ascertaining the requirements of those persons in your province principally interested in the Exhibition of 1867. If you cannot yet obtain precise information as to the exact space our exhibitors will require, you will at any rate be able to procure general indications as to their probable participation in the coming Exhibition, and thus to furnish me with those elements without which the interests of our countrymen might not be sufficiently guaranteed.

"I request you, M. le Gouverneur, to omit no pains to obtain the most exact information, and to place yourself for that purpose directly in communication with the competent authorities and the chief manufacturers of your province. I ask your zealous assistance in this matter, and, as the affair is urgent, pray you to acquaint me with the result of your inquiries with the least possible delay.

(Signed) "A. Vandenpeereboom,
Minister of the Interior."

Fine Arts.

Paris Exhibition.—The annual exhibition of Fine Arts opens, as usual, in the Palais de l'Industrie, in the Champs Elysées, on Monday, the 1st of May, and the collection is expected to be beyond the average in quality, as it will certainly be in quantity. The weather just now is magnificent, and those who can spare the time for a trip to Paris in May, or the first half of June, will have a fair chance of seeing the city in its gayest aspect, besides having the opportunity of studying the results of French art on a large scale, and at their ease, for the size of the building and the enclosed garden, in which the sculpture is always admirably exhibited in the midst of green lawn and glowing flowers, supply together one of the finest places for such a purpose in Europe.

Photograph of Dante.—The portrait of Dante painted by Giotto in a fresco in the chapel of the prison of the Bargello, in which the immortal poet was once incarcerated, is well known to the artistic world, but the engravings of the work give but a very poor idea of it. A photographer has recently succeeded in obtaining an admirable reproduction of it, which is about to be published in five different sizes, from that of a *carte de visite* to half that of the original.

Manufactures.

Tuscany Straw Work.—It appears by an official report that the annual value of this industry is about half a million sterling. The soil of Tuscany is said to be the only kind in Italy which will produce straw of sufficient fineness for the purpose, and it is only in the immediate neighbourhood of Florence itself that the highest quality can be produced. The farmers of the Romagna, the Marches, and of Naples, have often attempted to grow it, but have never completely succeeded. The straw in question is that of a peculiar kind of wheat, which never attains more than fourteen or fifteen inches in height, and bears very few grains of corn. The sewing together of the plats is as nice an operation as the platting itself, and each requires great practice and infinite patience. More than half a million of straw bonnets are made each year in Florence. In certain localities, such, for instance, as Empoli, 4,000 or more women are employed in the trade; Sesto has about half that number.

Galvanic Pile.—At a recent meeting of the Academy of Sciences, M. Matteucci read a paper "On the Action of Sulphur in the Galvanic Pile." The author has experimented on the battery recently introduced by M. Blanc, who employs a plate of zinc and a plate of lead covered with a very thin deposit of copper, which are placed in a solution of common salt, with which is mixed a quantity of sulphur. This battery appears to be very useful for telegraphic purposes, and the only objection to its use is the evolution of some suphuretted hydrogen, which would seem to be unavoidable. In the course of his experiments the author arrived at the following conclusions:—1. That finely-divided sulphur in contact with the electro-negative metal of a pile formed of zinc, copper, and solution of common salt notably increased the electromotive force, constancy, and permanency of the battery, and he hopes to obtain by the use of sulphur a voltaic combination possessing many advantages over the batteries at present employed. 2. Sulphur, although insoluble and an insulator, enters into combination with the sodium set free by the current. It remains for the author to explain the action of the small quantity of sulphide of copper which is formed, and which appears to be essential. For this end he has undertaken further experiments.

Commerce.

The Stagnation of Commerce.—Messrs. Travers and Son, in their circular, say:—"Probably at no previous period has there ever been a more general stagnation of commerce than at the present moment. Instances have been known of more severe depression in this and other countries, but none in which the limitation of business was so universally observed in all parts of the world. In the United States the imports of the past six months have scarcely been more than a fifth of those of the corresponding months of last year; in India the suspension of transactions is reported by the most recent telegrams to be almost complete. From China the accounts are equally discouraging, while in South America, Australia, &c., although the markets are less flat than elsewhere, there is no particular activity. Of course the brunt of this great change will have to be sustained by England; but our manufacturing and producing power is so extensive and varied that we have more capability than other nations of sustaining ourselves under exceptional circumstances. Hence, although the evidences of the contraction of trade are seen among us on all sides, they are less apparent here than in France, where the unprecedentedly rapid accumulation of the stock of bullion is a consequence of the reduced demand for money for commercial purposes. At the beginning of the year it was a question in this country, whether the diminution in the commercial demand for money, would so far counteract the effects of the requirements for our headlong commitments to foreign loans and undertakings, as to allow a decline of the rate of discount to 5 per cent.; but it is plain that the extent of the impending revulsion was then underestimated, and now that the slackness in our industry has been aggravated by circumstances taking place in the iron trade, which have caused large orders to be sent to Belgium, the prospects seems to be that the rate may remain for some time at the present point, even if it should not temporarily go below it."

Colonies.

Colonial Societies.—A movement has been originated in Victoria for the establishment of a Society of Arts, Manufactures and Commerce, the objects of which are to be the encouragement of arts and manufactures in this colony by disseminating information thereon, and by bestowing pecuniary and honorary rewards for such productions, inventions, and improvements in this department, and the introduction of new industries, as tend to promote emulation, economy, and consumption, more extended employment, increase of social enjoyments, of trade and commerce, and of national wealth. A similar society is suggested in the Hobarton papers for the colony of Tasmania, which has already done much good through its Royal Society, Mechanics' Institutes, Agricultural and Horticultural Societies.

Acclimatisation in Victoria.—At a meeting of the Council of the Acclimatisation Society of this colony, a letter was read from J. A. Youl, declining to undertake the shipment of another lot of salmon ova, and stating that he has for various reasons been obliged to decline a similar request made by the Tasmanian salmon commissioners. A letter was read from Mr. R. Philpott, giving some further particulars about the shipment of Angora goats, and advising that, if possible, a further sum of money should be sent home for the purchase of these animals. Dr. Black mentioned that it was at his suggestion the Council had determined to import some of the Angora goats, convinced as he was that there was no animal more worthy of the exertions of the society, or one that would redound more to their credit to establish there. After a conversation as to what amount should be set apart for this purpose, it was unanimously determined to devote a further sum of £900 for the introduction of Angora goats, thus doubling the amount already in Mr. Philpott's hands. A letter was read from Mr. Layard, of Colombo, stating that he had sent three axis deer and one Ceylon elk. (These have arrived in good condition.) Letters were also read from California, stating that seven of the Californian mountain quail had been received at the Botanical Gardens, and that the Sambur deer had arrived safely at Yallock; and speaking in sanguine terms of these fine animals soon penetrating into the Streletzski Ranges, and becoming established there. The secretary reported that he had received two tortoises and two ostrich eggs from Mr. J. Mackie, who brought them from the Cape. Mr. Mackie states that it is now quite a common thing for the farmers to have a flock of ostriches in a state of semi-captivity, and that a very large profit is derived by the sale of the feathers. Mr. Mackie thinks that the eggs might without much difficulty be brought to this country and hatched, where he has no doubt the breeds would thrive and do well. They were to be collected together at the Exhibition building between the 1st and 10th of March, and the whole despatched by the *Great Britain*, which was to sail on the 15th of that month. The board appointed to promote the objects of the present undertaking have availed themselves of the experience of Mr. J. G. Knight, the secretary to the commissioners for this colony at the London Exhibition in 1862, in the executive management of the matter.

Notes.

Danish Industrial Exhibition.—The Danish papers contain intelligence that the Government has resolved to hold an industrial and artistic exhibition at Copenhagen in 1866. A committee has been formed for the purpose, consisting of twenty-five members, presided over by the Crown Prince Frederick. The chairman of the committee is Councillor Forchhammer. The exhibition is to be opened on the 1st June, 1866, in the riding-house of the Castle of Christianborg, and will include raw stuffs, as well as manufactured goods and objects of art.

Hydraulic Works in the Doubs.—A very important work is about to be undertaken in the department of the Doubs, in France, with the object of economising and regulating the waters of the lakes of Saint Point and Remoray, and of improving the river Doubs from the lake of Saint Point to the point where the Doubs empties itself into the Saône. The actual level of the lakes is to be lowered, two hundred acres of marshy land reclaimed, and the drainage of the entire neighbourhood re-arranged; finally the lakes will be deepened, so as to increase and regulate the water power, which is used by ninety factories of various kinds on the Doubs. The cost is estimated at £96,000, but the value to the existing factories is set down at £24,000, and it is expected that a large number of new works will spring up in consequence of the improvements to be made.

Autographic Telegraph.—It is officially announced that the new telegraph, which heretofore only operated between Paris and Lyons, will be opened to the public, on the 1st of May, between the former city and Havre.

Gas Lighting in Paris.—The consumption of gas in Paris has doubled in the eight years from 1857 to 1864. The Compagnie Parisienne d'Eclairage sold, in 1857, 1,979,134,379 cubic feet, and in 1864, 3,870,600,105 cubic feet, about half the total quantity supplied. There are about 687 miles of mains only. There is a good market for the coke, and the ammoniacal sold for £5,121. The Paris Company, in order to induce the sale of their coke, make and sell at cost price a stove specially adapted for burning this material in houses and shops, and of these stoves they sold no less than 2,755 in the year 1864; the total number in use at the end of that year was 11,291.

Lenoir Gas Engine.—There were, on the 31st of last December, no less than 143 of these ingenious, simple, and compact little engines working in Paris to the satisfaction of those who employ them.

Correspondence.

City Horticulture.—Sir,—As city horticulture is by no means confined to flower shows, so neither is window gardening restricted to pots of flowers, or to appliances to be added after the houses are built. If window gardening be a pleasant and cheerful thing why should it not be provided for in the first instance by architects in their designs, and by builders in their structures? By the provision for the indulgence of this taste thus becoming a forethought instead of an afterthought, not only would greater capacity be obtained in the receptacles for these miniature *parterres*, but greater elegance and more harmony with the elevations of the buildings. Indeed, it may fairly be hoped that improved arrangements for the gratification of this taste may lead to new architectural features of much beauty. For instance, the sills of windows are sometimes made to continue the string courses running along the frontage; that is, often the string courses run immediately below the windows. If, therefore, the receptacles of these miniature gardens project somewhat, immediately at the base of the windows, and they are ornamented with patterns, why should not these patterns be continued on the string course? If these receptacles be in iron, they might be painted terra cotta colour and the rest of the string course be supplied in terra cotta to match, or if porcelain or encaustic tiles face the window gardens, why may these not also be continued in the same fashion on the remainder of the string course? Supposing two or three rows of windows on a house or row of houses thus decorated with different agreeable patterns running along the string courses and window-gardens, they would surely have a pleasing effect? If a builder, in constructing a row of houses, say, for the artizan class, were thus to fit up and decorate each alternate house with window-gardens, leaving each alternate one plain, I fancy he would find that the former would go off his hands before the others. And I would submit the suggestion that a premium for such designs of house elevations, combining window gardens in pleasing harmony with architecture, might legitimately appear in the Society's prize list for next year. We frequently hear complaints of want of novelty in architecture, and provision as above for the indulgence of the taste for flower-growing, in union with architecture, in this most nature-loving metropolis, would afford one feature of originality which would really belong to us.—I am, &c., John Bell.

Photography on Painting Canvas.—Sir,—Will you kindly correct an error which occurs in your journal of the 21st inst. On page 380 credit is given to the Belgians for having devised a successful method of printing by means of photography on painters' canvas. The method referred to is my process with collodio-chloride of silver, described at a recent meeting of the Photographic

Society. I desciibed its application to painters' canvas in the *Photographic News*, on February 10th. The article in whch I described it was translated into a Belgian journal, and duly acknowledged; from thence it was transferred into a French journal, quoted as from the Belgian journal, the acknowledgment of the original source, doubtless inadvertently, being omitted. This is probably the origin of the error. By correcting it you will much oblige, yours, &c., G. Wharton Simpson.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Entomological, 7.
British Architects, 8. Annual Meeting.
Asiatic, 8.
Royal Inst., 2. Annual Meeting.
Tues. ...Society of Arts, 8. Cantor Lectures. Dr. F. Crace Calvert, "On some of the Most Important Chemical Discoveries made within the last two years." (Lecture IV.)
Civil Engineers, 8. Mr. Callcott Reilly, "On Uniform Stress in Girder Work." (Part II.)
Royal Inst., 4. Prof. Frankland, "On Organic Chemistry."
Wed. ...Society of Arts, 8. Mr. William Stones, "On Colonisation; its Aspects and Results."
R. Society of Literature, 8½.
Thurs...Royal, 8½.
Antiquaries, 8.
Linnæan, 8.
Chemical, 8.
R. Society Club, 6.
Artists and Amateurs, 8.
Royal Inst., 4. Prof. Frankland, "On Organic Chemistry."
Fri.......Philological, 8.
Royal Inst., 8. Professor Henry Fawcett, "On Wealth and those who produce it."
Archæological Inst., 4.
Sat.......Royal Inst., 4. Prof. Bain, "On the Physical Accompaniments of Mind."

Patents.

From Commissioners of Patents Journal, April 21st.

Grants of Provisional Protection.

Air engine (compressed)—818—A. B. Baron Von Rathen.
Alumina, sulphate of—900—A. A. Croll.
Boots and shoes, feet protectors to be used loose in—908—J. Poole and T. Brown.
Buildings, construction of—822—J. Tall.
Buttons—1007—G. Davies.
Cartridge boxes—902—A. V. Newton.
Centrifugal force, rinsing and drying by—604—H. A. Bonneville.
Coal, machinery for mining—558—G. Lauder.
Coffee, substitute for—979—M. Diosy.
Cornice rings, manufacture of—977—C. H. Williams.
Cornices, ventilation by perforated tubular—813—T. H. Saunders.
Drying wool, cotton, &c., system of—255—E. T. Hughes.
Engines, governors or regulators for—991—S. Smith & J. W. Jackson.
Engines, traction—962—J. G. N. Alleyne.
Fabrics, dyeing and printing—804—A. Paraf.
Fibrous substances, machinery for carding—983—J. Ellis, C. Walker, and W. Preston.
Fibrous substances, preparation of—948—A. and H. Illingworth.
Files, machinery for cutting—1013—T. Turton.
Fire, apparatus for giving alarm in case of—267—M. Cartwright.
Fire-arms—969—C. W. Lancaster.
Fire-arms, breech loading—987—A. Muir.
Forks, cleansing and polishing of—950—C. Martin.
Gas, regulating the supply of—972—C. Esplin.
Grain, apparatus for threshing, &c.—742—J. Marshall.
Hammock, portable covered—894—T. W. Nordenfelt.
Hay, straw, &c., machines for cutting—934—R. R. Riches and C. J Watts.
Heat or cold, preventing the transmission of—864—F. Le Roy.
Inking rollers, manufacture of—914—A. V. Newton.
Iron ships, &c., protecting from oxidation—970—E. Ritherdon.
Kitchen ranges—940—F. Brown.
Lamps, reflectors for—897—B. Baugh.
Lighthouses, apparatus for illuminating—945—J. R. Wigham.
Locks—999—N. G. Kimberley.
Looms—928—A. W. Pearce.
Matches, &c., frame-filling machines for—1003—H. J. Simlick.
Motive power, apparatus for obtaining—3140—W. A. Turner and T. T. Coughin.
Musical instruments, stringing and tuning—954—W. Moody and W. J. Huband.
Nut crackers, &c., handles of—993—T. White.
Oil and grease, lubricating—966—W. Teall, L. Lepaige, and E. T. Simpson.
Ornamenting metal tubes, machinery for—924—G. Burt.
Photographi cameras—1009—V. A. Prout.
Photographic images, production of—712—R. A. Brooman.
Postage stamps, &c., manufacture of—936—J. H. Johnson.
Projectiles and cartridges—932—J. von der Poppenburg.
Railway breaks—745—H. A. Bonneville.
Railway carriages, &c., stopping or retarding—1021—G. Voigt.
Railway trains, communication between the guard and passengers of—858—H. J. Walduck.
Railway trains, communication between the passengers and guard of—929—J. C. Stovin.
Safes, construction of—904—T. Cook.
Safes, manufacture of—585—S. Chatwood.
Safes, securing the doors of—946—G. C. Thompson.
Sewing machines—848—E. H. Smith.
Sewing machines, binding attachments for—601—H. E. Clifton and A. Hoffnung.
Shaping machines—896—W. M. Neilson.
Shot, shell, &c., rounding and polishing—952—W. Clark.
Sizing paper—1005—W. Weatherley.
Soda and potash, manufacture of—1011—A. G. Hunter.
Steam boilers—906—J., D., B., and O. Swarbrick.
Steam cultivation—956—W. Bulstrode.
Straw, apparatus for reducing—985—R. Garrett, jun.
Telegraphic apparatus—910—H. A. Bonneville.
Toast racks, manufacture of—811—J. Burley and L. Glover.
Vegetable materials, separating fibre from—958—G. T. Bousfield.
Washing machines—605—H. A. Bonneville.
Weights, safety tackle for raising—937—P. J. Jamet.
Yarns or threads, machinery for finishing—1019—R. Fergusson and W. Ralston.

Inventions with Complete Specifications Filed.

Mineral oils, lamps for burning—1040—C. Boschan, J. Bindtner, an W. Caffou.
Vessels, connecting a gaff to the mast of—1067—C. R. Fisher.

Patents Sealed.

2584. G. Hartley.
2593. J. Shaw.
2602. G. Davis.
2603. J. E. A. Gwynne.
2606. C. H. Gardner & C. English.
2617. A. Muir.
2619. W. O. Walbrook.
2626. E. E. Colley.
2630. J. Smith.
2631. J. W. Scott.
2633. H. Bateman and E. G. Garrard.
2635. G. T. Bousfield.
2636. J. Heap and T. Jolley.
2652. J. and R. Cunningham.
2655. P. A. le Comte de Fontaine-Moreau.
2657. J. Walmsley and N. G. Pitman.
2668. J. and H. Charlton, and J. O. Christian.
2709. E. Pilkington.
2715. C. W. Wardle and R. McIntyre.
2730. H. B. Harris & J. P. Thomson.
2739. T. N. Kirkham, V. F. Ensom, and H. Brook.
2742. J. R. Crompton.
2743. D. Ellis and M. Hillas.
2762. A. Field.
2764. W. B. Adams.
2773. J. H. Johnson.
3049. A. D. Hall.
3115. W. Bardwell.
3225. J. and W. Thornton.
11. M. Benson.
57. E. Beanes and C. W. Finzel.
162. E. Williams.
173. J. Hewes.
412. W. B. Newbery.
473. J. G. N. Alleyne.
488. C. V. and A. O. Walker.

From Commissioners of Patents Journal, April 25th.

Patents Sealed.

2607. A. Reynolds.
2637. H. E. Craven & T. Carrack.
2638. J. Tate.
2645. J. Dannatt.
2650. B. F. Brunel.
2651. F. Jenner.
2658. C. May.
2661. J. Stobo and W. Pollock.
2663. W. Congalton.
2666. D. Laidlaw and J. Robertson.
2673. W. Cormack.
2678. A. and W. Smith.
2687. J. H. Simpson.
2688. C. O. Crosby.
2694. E. Edwards.
2695. J. F. Brinjes.
2703. W. Aston.
2729. J. Dodge.
2735. H. A. Gwynne.
2753. G. Simpson.
2777. S. Rydbeck.
2789. J. Robinson & J. Gresham.
2806. G. Smith.
2825. H. W. Ripley.
2831. G. Bell and R. Luthy.
2863. W. E. Newton.
2979. A. V. Newton.
3028. W. E. Newton.
3174. W. Reid.
3238. J. H. Johnson.
96. J. G. Jones.
165. J. A. Shipton and R Mitchell.
332. C. Beard.

Patents on which the Stamp Duty of £50 has been Paid.

1044. J. F. Mathias.
1201. F. Dangerfield.
1152. J. Combe.
1165. C. C. Creeke.
1294. T. F. Griffiths.
1218. A. C. Kirk.
1190. C. E. Heinke.
1235. G. Bischof, jun.
1461. A. Nicole.
1199. J. F. Allen.
1210. R. C. Mansell.
1215. J. Shaw.

Patents on which the Stamp Duty of £100 has been paid.

856. M. Rowan & T. R. Horton.
876. J. Horsey.
903. C. Lungley.
875. W. H. F. Talbot.
925. E. Hunt and H. D. Pochin.
978. L. Talabot.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, MAY 5, 1865. [No. 650. VOL. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

MAY 10.—"On the Art of Laying Submarine Cables from Ships." By Captain JASPER SELWYN, R.N.

MAY 17.—"On the Manufacture of Encaustic Tiles and Ceramic Ornamentation by Machinery." By ZERAH COLBURN, Esq.

CANTOR LECTURES.

The Third Course for the present Session, consisting of six Lectures, "On Some of the Most important Chemical Discoveries made within the last Two Years," by Dr. F. CRACE CALVERT, F.R.S., F.C.S. (Corresponding Member of the Royal Academy of Turin; of the Société Industrielle de Mulhouse; of the Société Imperiale de Pharmacie de Paris, &c.), is now being delivered on Tuesday evenings, at Eight o'clock, as follows:—

MAY 9TH.—LECTURE 5.—On the Discoveries in the Chemistry of Rocks and Minerals.

MAY 16TH.—LECTURE 6.—On the Discoveries in the Chemistry of Metals and Alloys.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture.

Proceedings of the Society.

TWENTY-FIRST ORDINARY MEETING.

Wednesday, May 3, 1865; M. H. Marsh, Esq., M.P., Vice-President of the Society, in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Balfern, John Edward, 6, The Lawn, Shepherds'-bush, W.
Bedder, William, Saltash, Cornwall.
Boroschitzky, J. F., 32, Tavistock-place, W.C.
Botly, William, Salisbury Villa, Upper Norwood, S.
Buckley, R. S., Mossley, by Manchester.
Clever, Joseph, 7, Coleman-street, E.C.
Cozens, Samuel E., Phœnix Wharf, Southwark, S.E.
Davison, Thomas Langmore, 2, Lavender-terrace, Lavender-hill, S.W.
Edwards, Samuel, 13, Limes-grove, Lewisham, S.E.
Green, John, 2, Gloucester-place, Lower Tulse-hill, S.
Hawke, John, 3, Brockley-villas, Brockley-road, New-cross, S.E.
McClellan, Samuel, 7, Cambridge-terrace, Upper Lewisham-road, S.E.
Shanks, James, St. Helen's, Lancashire.
Skelton, John, jun., M.D., 105, Great Russell-street, W.C.
Taplin, Thomas, 14, St. James's-square, S.W.
Westhead, Albert, 20, George-street, Hanover-square, W.
Westhead, Edwd. S., 20, George-street, Hanover-sq., W.
Wilkinson, T. L., 1, York-villas, Sydenham-park, S.E.
Wynne, F. Osborne, Archcliffe Fort, Dover.

The Paper read was—

ON COLONIZATION; ITS ASPECTS AND RESULTS.

BY WILLIAM STONES, ESQ.

Having had the honour, a few years ago, of submitting to this Society a short notice of the colony of New Zealand, which led the way, I believe, to the reading of several very interesting papers treating of the colonies of Canada, the Cape of Good Hope, Mauritius, and a most important contribution by Dr. Forbes Watson on Indian matters, it has occurred to me that the Society might follow up the subject, and advantageously occupy an evening in the discussion of several topics not appertaining to any one colony in particular, but in connection with colonisation generally.

The short time at our command, and the space in the *Journal* to which I am limited, compel me to suppress several subjects possessing some interest, and, therefore, I pass over all reference to the different forms of ancient and modern colonisation—the aspect of colonisation in its relation to the religious institutions of England—to our literature—to English amusements—to the important question of the effects of colonisation on other races, whether slavery, extermination, or incorporation—and, lastly, to another interesting subject, the peculiar genius of Englishmen for colonising. All these on the present occasion must be omitted.

Limiting our views to the British colonies and dependencies, we may notice their number, situation, and climate. Stretching almost entirely round the globe—extending from the nearest habitable land to the north pole, through the tropics to the Falkland Islands and New Zealand in the southern hemisphere, every variety of climate, position, and production is included within the limits of the British Dominions.

Parts of all the great continents are held by Great Britain—as Canada, in North America; Honduras and British Guiana, in South America. In Africa, besides the stations of the Gambia, Gold Coast, and Sierra Leone, we have the colonies proper of the Cape of Good Hope and Natal. By our magnificent Indian Empire, Singapore, and the treaty ports of China, Asia is, to a great extent, brought under British control; while the whole continent of Australia (and I presume it may take rank as one of the five great powers) is entirely under British government. On the Continent of Europe, after all our wars and expenditure, we retain but one little spot—the coveted stronghold of Gibraltar, the key of the Mediterranean.

As a seafaring insular people, it might be supposed that we should have a natural bias or inclination to form settlements on islands; and beginning from Heligoland and the Channel Islands at our own doors, we shall find, if we trace along the subjoined sketch map, islands without number hoisting the British flag.

We note Newfoundland, Prince Edward's Island, the Bermudas, Bahamas, the West India group, Falkland Islands, St. Helena, Mauritius, Ceylon, Singapore, Hong Kong, a station in Labuan, Van Dieman's Land, and the cluster of islands known as the colony of New Zealand, and, lastly, Vancouver's Island—and Malta, in the Mediterranean; but it is quite beyond my power to accurately reckon the number of islands claimed by England, as many of those I have named include several small satellites under their government.

Not less various are the climates—Canada, with its six months of frost, snow, and ice, massive, grand, and solemn in its features, bracing and exhilirating to her hardy inhabitants; the seething plains of India, suggesting disease of liver, brevity of life, and quickness of fortune; the milder climate of Australia, where health is so good that doctors find small encouragement, and frost is little seen or felt; the clearness of the Cape, where twenty oxen, slowly toiling, drag the farmer's waggon over the sandy soil, baking, broiling, dry, yet healthy; or the foggy coasts of Newfoundland. And here we may call attention to the difference which exists in climate between the two coasts of North America. The isothermal line of 50 deg. Fahrenheit enters the German Ocean in about 53 degrees north; it reaches its highest point in the British Isles, where it touches the parallel of 54 deg. north; after this it bends southward, until, on entering the American continent, it descends to the low latitude of 40 deg. north. In its course across America its deflection is on the whole northerly, and on the eastern side it again reaches to 54 deg. north.

The eastern sides of the Atlantic and Pacific Oceans are warmer, and the western sides colder, than is due to latitude merely. This fact was noticed by Captain Cook, and is owing to the cold polar waters washing the coast of Canada and China, while the warm streams from the tropics flow on to the coasts of England and Norway in the eastern hemisphere, and Vancouver's Island and British Columbia on the west coast of America. Hence, British Columbia and Vancouver's Island have much milder winters than places in Canada under the same parallel of latitude.

Rivers.—Some of the colonies and dependencies have large rivers, as the St. Lawrence, whose vast watercourse forms the great outlet of the magnificent chain of lakes or inland seas of North America. India, with its sacred mythical rivers, carrying us in thought back beyond the reach of authentic history; and the islands of New Zealand, which are pierced in every direction by numerous navigable streams. On the other hand, some of our largest colonies are almost totally deficient of rivers, as those on the great continent of Australia, in which railways must be relied upon to provide inland carriage.

Of harbours, we may boast the unrivalled Halifax and Sydney—one in each hemisphere—only perhaps exceeded in beauty by that of Rio de Janeiro.

Productions.—We shall hereafter refer to the variety of productions more in detail, suffice now to say that, in 1862, Canada sent us timber to the value of £1,237,689; that upwards of 21½ millions of sheep grew wool for us in Australia and New Zealand; and our own colonies of Australia and Vancouver's Island produced £8,000,000 of gold; while, of colonial sugar, we imported to the value of upwards of two millions.

Variety of Population, Religions, and Laws.—From the circumstance of so many of our colonies having been acquired by conquest, it almost necessarily follows that we must have a many-toned and hued population subject to British rule. We can only mention the French in Canada and the Mauritius, Dutch at the Cape, African blacks in the West Indies and in Africa, Hindoos, Chinese, Malays, Australians, New Zealanders. Nor are the religions less diverse—Protestant, Catholic, Mahomedan, Hindoo, Parsee, savages who believe in wood and stone images, and savages who have hardly risen to any idea of a God at all. Equally various are the systems of law in force—British law, Code Napoleon, local laws, and heathen customs, so long as they are not repugnant to good citizenship, are left tolerably free to their own workings.

Amongst all these varied peoples, tongues, colours, customs, and habits, British rule has, we believe, resulted in two profound convictions and enjoyments—a sense of perfect protection of person and property, and freedom of thought and action.

Acquisition.—Inspection of the accompanying table will at once show the very varying modes in which this country has obtained its colonies and dependencies. The column "mode of acquisition" testifies to many a hard-fought battle by sea and land. The tale of Wolfe's battle of the Heights of Abraham, or the attack and siege of Gibraltar, cannot be read at this distance of time without feelings of glowing pride. Every West India island has its tale of courageous attack or sagacious defence. And those which tell of less warlike deeds are not without their interest from another point of view. We owe our acquaintance with them to the privations, patient endurance, skill, energy, and genius of such bold, self-reliant men as Cook, who, in vessels not larger than a moderate-sized yacht (the *Investigator* we all recollect lying off our hall of meeting until within the last few years, doing good service in her last days in the humble form of a Thames Police-station), sailed into unknown seas at the Antipodes, tracked and surveyed the strange coasts, returning home with important results, and contributing largely to the geographical and scientific knowledge, and high moral position of his native country. So judiciously did he conduct his explorations and communications with savage tribes that his name is still remembered in the South Seas as the introducer of various animals and vegetables with which the people were previously unacquainted, and the name of Cook is revered as their kind and courteous benefactor. No one ever heard in those regions a whisper against his fair fame.

Social Aspects.

Few rich people emigrate; few with a good commercial opening before them leave the land of their birth. Strivers amongst the middle classes, younger sons, poor and labouring men, principally the latter, are the classes of which emigrants principally are and should be composed—men with restriction of field at home and small margin between income and necessary expenditure. The two aspects of colonisation from a social point of view, which I wish prominently to bring before you, are—

1st. The direct benefit to the emigrant; and 2nd. The indirect benefit to the home-stayer.

The Emigrant.—A competent workman no sooner arrives in any of the colonies than he finds ready and full employment at wages which, if economical and provident in his habits, leave him a large margin between income and outgoings. Taking the agricultural as the lowest type and worst paid of English workmen, the farm labourer on reaching a colony obtains for his work both money payment and ample rations, the former alone generally averaging more than his total highest remuneration at home. He is thus at once relieved from all care on the subject of procuring food. Meat, which in England he tasted perhaps once a week only, he now has every day, and three times a day if he likes; and the weekly wages, which in England had to provide him with food, housing, and clothes, can now be devoted to the purchase of luxuries, or, if prudent, by saving a portion of his income for a time, he can soon reach a position enabling him either to buy a small plot of land for himself, which he can always obtain for a few shillings per acre, or to join in the renting of a sheep-run on shares, thus laying the foundation of a fortune. A few years of more or less rude success, during which the emigrant has learnt self-reliance, and he, who would probably have passed his life at home as a mechanic, or, perchance, risen to the dignity of a foreman, and unless by special fortune never attained to any social or political importance, perhaps never possessed a vote, becomes in the colony a person of means, can afford to purchase a good house, good furniture, to live well, even luxuriously, is entitled to vote for local officials and the legislature, enters into the discussion of public matters, and gradually comes to have an opinion of his own, which he enunciates in the press or in speeches at public meetings, and every little place has its newspaper, in which argumentative colonists carry on their discussions. These discussions determine his choice of a member for the legislature, if himself desirous of remaining a simple citizen, but if ambitious, he feels that no impediment exists to his becoming a legislator himself. With character and sufficient education he may succeed in leading a local assembly, but if limited in his oratorical powers he must be content to be a silent member, though not the less useful. Thus men, whose whole life would probably have been restricted to the questions of daily wages and the propriety of strikes, or a low murmur about their exclusion from electoral rights, gradually open their minds to questions of revenue, taxation, political freedom, colonial rights, exploration, harbours, fisheries, boundaries, settlements, education, the improvement of estates, and the general public good. These briefly are some of the advantages which accrue to those who emigrate.

Home-stayers.—The advantages to those who remain at home are numerous, although apparently less direct. First, there is the withdrawal of a large per-centage of competitors from the labour market. The law of supply and demand obtains, in the case of labour, as in that of other commodities. If a given number of employers have need for, say nine men, and ten workmen apply for the work, the employer will reduce the wages of all the nine required to the lowest possible amount; the labourers, in fact, compete with one another as to which one shall be left out of work; but if the employers have work for nine men, and only eight are obtainable, the employers compete with one another for the services of the men by offering inducements, generally in the form of increasing their wages. Hence, the importance of emigration, from a labourer's point of view—transferring the competition from the shoulders of the workman to those of the master. That this has been the case during the last ten or fifteen years will be evident, if we investigate the present rate of agricultural wages, and compare it with the rate which prevailed at the former period. I am aware that another cause besides emigration has been operating in the direction to raise wages—I refer to the introduction of machinery into agricultural pursuits. When threshing was done by manual labour, one man was almost as good as another, but the man who can drive, stoke, or feed a threshing-machine is no longer a common labourer, but a skilled workman; and unless his wages be raised above those of a mere labourer he will speedily seek some other engagement—his intelligence, his mind, must be paid for. With a diminution of demand, fewer permanent hands being now required upon farms, the great reason for wages being higher at the present time than formerly, can only be from the fact of large draughts of men having been enticed from England by the prospect opening to them in our colonies, and by that means withdrawn from the home-labour market.

Number of Emigrants from the United Kingdom, distinguishing the Nationality and Destination, for the Year 1862.

Destination of Emigrants.	Year.	English.	Scotch.	Irish.	Foreigners.	Not distinguished.	Total.
United States	1862	14,180	1,025	33,521	2,388	7,592	58,706
Brit. North America	,,	2,576	2,645	3,107	137	7,057	15,522
Australian Colonies.	,,	17,827	8,599	12,402	652	2,363	41,843
Other places	,,	904	327	650	134	3,123	5,143
Total...............	,,	35,687	12,596	49,680	3,311	20,140	121,214

From Mr. Morton's paper, read before this Society on 8th December, 1859, it appears that the wages of agricultural labourers throughout Great Britain have risen, on an average, about 20 per cent. between the years 1849 and 1859. All this proves, says Mr. Morton, that the labouring force in agriculture is better paid than it used to be, and that the enormous extension of machinery and of steam power lately has not been to the injury of the farm labourer.

Not only have wages been largely improved by emigration, but there is another point of influence upon social life which must not pass without mention. Speak to a person in whatever sphere of life we may, it will be almost instantly ascertained that a brother, sister, relative, or intimate friend is settled in some distant colony; and with such emigrants the dwellers at home keep up a correspondence more or less regular, bringing about a knowledge of the world and its varying interests vastly different from that which obtained only a few years ago, when it was not unusual to meet with persons whose geographical knowledge was bounded by the limits of their native village or town. I speak a fact when I say that within the last twenty years I have myself conversed with a country resident, the proprietor of the farm he cultivated, who, living within 25 miles of a railway and a seaport, to which steamers were running daily, had never seen either a railway, a locomotive, or a steam-vessel, and all my attempts at explanation utterly broke down when I found that his utmost idea of a steam vessel's mode of propulsion was by sweeps, as he termed them, similar, as he supposed, to the small oars of a boat on the mill pond. The views of the world which the emigrant obtains are scarcely less different than the expansion which is taking place in the minds of the home stayers on the great interests which affect our country. Further, every man who emigrates may be said to support one at home, by becoming a purchaser of English manufactured goods, and thus are the home-stayers benefited; to how large an extent will be more apparent when we have treated of the commercial results of our colonies. In fine, the physical, moral, and social condition of both these two great parties to which we have referred is rapidly changing and, I believe, improving. Two little incidents which, from their coming under my own notice, I may relate as bearing on this part of the subject. In the depth of a bitter winter, a group of labouring men were huddling round an inn fire, at which they were kindly permitted by the host to warm themselves, and, on

inquiring as to the cause of so many able-bodied men lounging about, I was informed that they could not get work, and were not allowed to go into the Union until they had been out of employment six weeks. They added that there were forty men in the like distress in that parish, a purely agricultural one, the coveted wages when in full work, for which they were so anxious, being some 8s. per week. Incendiary fires were frequent that autumn and winter; if my memory serves me correctly, eight were counted in my evening walks during one and the same week. Is it not appalling to reflect upon such a state of things? Starving men burning abundance. In my own mind, I have often contrasted this sad condition of matters with the cheering prospects indicated in the following simple tale, for the accuracy of which I also vouch. When I was in one of our colonies, an Irish emigrant once solicited me to write a letter for him to an old friend at home, which I assented to do. "Tell him," said he, "that if he has not plenty of work to come out. Tell him we came out safely and comfortably. Tell him, sir, it is a beautiful country. Tell him there is plenty of work here;" and then he related various domestic pieces of intelligence as to the increase of his family, &c. "Well," said I, after penning all the subjects as he dictated them, "anything more?" Considering awhile, he said, "Nothing, your honour, thank ye;" but, recollecting himself, added, "Oh, please, tell him there is plenty of pork and potatoes." A great truth lurks under this last sentence, for our physical well-being is at the foundation of all civilization, science, art, and the amenities of life.

Who should Emigrate.

This leads me to offer a few remarks on the great question—Shall I emigrate? Every person falls into one of two classes, desirable or dead-weights. Men with families, likely to settle down permanently and become the backbone of the colonies, are desirable, and if possessed of moderate capital, so much the better. Very desirable colonists are those working men who have a sound knowledge of some handicraft, as bricklayers, carpenters, masons, blacksmiths. Farm labourers, shepherds, are also valuable; and subordinate to these, all men enjoying good health, and able to do a hard day's work of any rough kind. Of the female class we should like a supply of country domestic servants, and handy lasses, knowing how to milk, wash, and iron, boil a potato, make a pudding, and roast a joint. To such we should be quite willing to give high wages as long as we could keep them from the allurements of some prosperous mechanic or successful farmer. Speaking as a colonist, I may say there are whole groups of people we do not want and would much rather be without. Of professional men we have more than enough. Legal men are so abundant at home, and the chances of great success so uncertain and rare, that no wonder the overflowings of the profession seek to obtain advantage of every opening possible in the colonies. Again, when it is remembered that every emigrant vessel must carry a surgeon, it will at once be seen how superabundant must be the members of that profession in some of the colonies. 40,000 emigrants go to Australia every year, conveyed in 160 or 200 ships, and as many of the surgeons do not return, but remain in the colonies, we may form some idea of the yearly addition to the medical branch of the community. The needlewomen, the sempstress class, are not of value to us; accustomed to town life, weak, feeble, unenergetic, not used to domestic work, they find little occupation, and are a burthen to us. For young men who have not learnt a trade, men of the pen only, we have but little room; there is always a large supply on hand, and as living is comparatively dearer than at home, they are the most disadvantageously placed of any class in the colonies. They know no trade or handicraft, and are, as a rule, physically unable to do laborious work, and therefore are far worse off than the commonest unskilled labourer. One morning, not long ago, a young man called upon me with a note of introduction, and informed me that he was desirous of my opinion on the subject of his emigrating. From his somewhat worn aspect and the aroma of strong tobacco which environed him, I was rather puzzled how to advise him, and therefore requested him to state his own views, projects, and ideas, so that I might confirm his plans or suggest some deviation. Judge my astonishment when I heard his first question, "What hats would you advise me to take?" "To sell?" said I. "Oh, no; to wear." Without meaning a pun or inuendo, I could not avoid saying, "A wide-a-wake." I need scarcely add, that young gentlemen who are very particular about the sort of hat they should wear, we do not much require.

Commercial Aspects and Results.

It is worthy of note that for the supply of the staples of our principal manufactures we, at the present time, mainly rely upon our own colonies and dependencies. The following very brief reference to a few of the principal items may suggest rather than fully demonstrate the extent of our transactions in this respect:—

Timber.—For timber we largely resort to Canada, New Brunswick, and Nova Scotia, whence we imported, in 1862, no less than to the value of upwards of three millions sterling. Mahogany is obtained from Honduras, and teak we obtain from our Indian possessions.

Cotton.—The cultivation of cotton has so far progressed in our own dominions, more especially since the war in the United States, that the import value in 1862 from purely British possessions, was no less than eleven millions sterling.

Wool.—For the important staple of our wool manufactures we now, to a very great extent, depend upon the vast pasture lands of Australia, the Cape of Good Hope, and Natal; the total value of the wool produce of those colonies being now estimated at £6,832,578 per annum.

Fish forms a large article of trade and export from some of our North American colonies, to a greater extent than most of us would suppose, viz., £1,450,000 yearly.

Sugar.—We imported from our West India Islands, the East Indies, and the Mauritius, to the value of nearly £3,500,000.

Gold.—All will recollect seeing in the Exhibition of 1862 the pyramid representing the mass of gold obtained from Australia since the discovery of that precious metal there in 1851. The pile represented many millions sterling, more than ever came into the possession of Crœsus or the desire of Midas.

Total Gold Productions from 1850 to 1863 Inclusive.

Old Sources	£202,793,000
British Columbia	5,605,000
Australia and New Zealand	136,388,000
California and United States	142,200,000
Other Countries	1,018,000
Total	£488,004,000

These most important and valuable items of our colonial commerce are for the most part either the unassisted productions of nature, needing but the rudest kind of labour to extract them from their sites, or prepare them for the market, or otherwise requiring but the simplest form of attention as sheep farming, and chiefly depending upon the mild equable character of the climate for successful and profitable results. Let me here call attention to the following return of exports from our colonies, extracted from the Board of Trade Returns for 1862:—

Exports from the Colonies and Dependencies, 1862.

Cotton	£10,203,470
Coffee	2,141,310
Fish	1,450,819
Gold	8,799,553
Rum	553,177
Sugar	6,600,232
Wood and timber	3,263,044
Wool	8,305,152

Principally sent to Great Britain.

How are these mighty heaps of raw produce paid for by the mother country? Chiefly, if not entirely, by its manufactures.

In a populous country only the most skilled workman has at all any chance of success; the mere manual labourer remains, as a rule, in his routine sphere of everlasting grinding work; but in a new country the most ordinary, least-skilled labourer rises into a condition of hope, and by his largely-increased wages, can and does become a great consumer of English manufactured goods. As a general principle, it is cheaper and better for the colonies to send home their raw materials to be prepared by the skill, machinery, and appliances of England, and re-import the manufactured goods, than attempt to work up the raw material in the colonies. The abundance of coal, the perfection of machinery, and the cheapness of labour, all tend to secure this result in the most economical manner; hence the wisest of the colonial governments look for their continued prosperity rather to the still further development of their unexhausted, and, in many cases, almost inexhaustible natural resources, than to the introduction of manufactures.

The necessary revenue is generally raised by a moderate import duty upon the principal articles of consumption, by an export duty upon some articles of great production, assisted by the proceeds of the sale of government waste lands. A few of the colonial legislatures have unwisely increased the import duty upon some articles, even more with a view to protect their incipient manufactures than for strictly revenue purposes, thereby artificially raising, to the injury of all, the price of the highly-taxed article for the benefit of the very few colonists who may enter into the manufacture of the goods thus selected for special taxation. This course is a great wrong to the body of colonists and most injurious to the English manufacturers, who help to pay the taxes—increased for the defence of the colonies—and we plainly state to our colonial friends that this short-sighted policy is bearing and will bear bitter fruits for them in all discussions of colonial questions. Not many have adopted a tariff of this kind, and obviously such a course is contrary to the first principles of political economy.

Disregarding these pernicious exceptions, we may say, speaking generally, that in return for the raw materials supplied by the colonies the mother country pays in manufactured goods of all kinds. In proof of this we have only to refer to the list of exports, from which it will be seen what extensive customers our colonies annually are to the mother country.

Exports of British and Irish Produce and Manufactures.

The following is an account of the declared value of British and Irish produce and manufactures exported from the United Kingdom to each British possession in the year 1864:—

	£.
Heligoland	15
Channel Islands	1,016,171
Gibraltar*	1,206,206
Malta and Gozo	746,385
Ionian Islands (ceded to the Kingdom of Greece June 2, 1864)	110,238
Western Africa (British)	269,173
Ascension	10.303
St. Helena	34,542
Cape of Good Hope	1,814,877
Kaffraria	29,365
Natal	428,135
Mauritius	658,258
Aden	31,758
India:—Bombay and Scinde	9,176.386
Madras	1,590,233
Bengal and Pegu	9,128,526
Singapore and the Eastern Straits	1,185,680
Ceylon	828,368
Hong Kong	1,610,957
Australia:—West Australia	97,596
South Australia	1,116,767
Victoria	5.316,933
New South Wales	2,742,780
Queensland	451.365
Tasmania	266,926
New Zealand	1,866,312
British North America	5,611,276
Bermudas	656,777
British West India Islands	2,659,778
British Guiana	803,503
Belize (British Honduras)	205,015
Falkland Islands	12,826
Total to British Possessions	51,683,430

* The return for Gibraltar must, I should suppose, have some mysterious connection with Spanish smuggling, or is it purely as the depôt of the Barbary States that it figures so high.

Several other points of commercial interest, deserve a short notice in this review.

Ship-building.—At the earlier period of our colonial history, ships were small, their provisioning bad and scanty, the water disgusting, voyages long and tedious. As the number of emigrants increased, it became advisable to enlarge the size of the ships, which brought another view into the consideration of the owners—the shorter the passage the *less* provisions would be consumed, and hence the shipowner came to have a direct interest in lessening the duration of the passage to the lowest possible period, as the value of every day's provisions for three or four hundred persons amounts to a considerable sum. Hence sprang improvements in ship-building, and increased attention to the routes, great circle sailing, and observations of the trade winds, the best points for crossing the line so as to avoid delay from calms, the importance of making southing as fast as possible, to lessen the length of the degrees of longitude, &c. As a rough approximate rule, it may be taken that a ship of 400 tons register would be 110 days making the passage to Australia, and every increase of 100 tons in burden would decrease the passage two days, or for each enlargment of 50 tons, one day less in the passage may be reckoned; if this is approximately correct, a vessel of 1500 tons register would make the passage in 88 days.

The legal enactments for the provisioning both of poor emigrants and sailors have tended very much to the comfort of all; and whereas disease, particularly scurvy, formerly destroyed large numbers of our seamen, we seldom hear of a case of total or even serious attack of that malady. So far from the long voyage being now hurtful to the health of the emigrants, this generally improves on the passage—they have no pressing anxieties, are well and regularly fed, breathe the fresh invigorating sea air, and have an ever present medical attendant in case of sickness.

Our prinicpal steam packet companies owe their development to the necessities of our colonial intercourse rather than to foreign trade. Nor ought we to omit noticing the vast strides which steam ship-building has taken, not only for the requirements of main ocean lines, but in every part of the world. On local lines of traffic, steam vessels built in the Thames, Mersey, and Clyde, are daily coasting the shores of India, New Zealand, and Australia, and the two widely separated coasts of British North America, driven by men of English northern tongue; some may be, like Albert Smith's engineer, enduring and fattening upon a grievance, but for the most part all doing their duty honestly and thoroughly as Englishmen should.

Banks and Monetary Interests.—Another important commercial interest is that connected with banking and monetary affairs. Some of our most prosperous banking

institutions have their principal seats or spheres of action in our colonies and dependencies. Their uniformly sound management causes them to furnish safe investments for English capitalists, and the high rate of interest in the colonies enables them to pay large dividends regularly. From the columns of the *Economist* I have compiled the following schedule, which, necessarily imperfect, as it only includes those which have agencies or branches in England, may illustrate rather than exhibit the vast monetary interests which open fields for investment in connection with our colonies. Some of the great loans are guaranteed by the British Government, and the money raised has generally been honestly applied to the furtherance of the true interests of the colony.

(Want of space will only allow of the totals being given.)

Grand Total.

Stock, Loans	£50,236,093
Railways	78,899,635
Banks, Insurance, and Miscellaneous Companies	44,823,737
Total	£173,959,465

Hence we have engagements for the great total of one hundred and seventy-four millions sterling, invested under the laws of our own country, and in many instances guaranteed either by the Colonial or Indian Governments, and in some cases by the Home Government, yielding at an average rate say of 7½ per cent. per annum, an income or profit to the investors of thirteen millions, without fear of repudiation or revolution.

Postage, Telegraphs, Railways.—The enormous dimensions of our oversea postal system are largely owing to the increase of population in our colonies. I would merely remind you that in almost every day's *Times* you may read of vessels from the east or west with so many passengers and, without exaggeration, letters numbering up to hundreds of boxes. These hundreds of boxes contain thousands of messages of goodwill towards men—cheerful, loving words from children to parents—remittances of comfort to the old folks*—family gossips and the effusions of affection borne on the waters from afar to many cottage homes in the land.

Telegraphs either have been laid down, or are in course of construction, from England to India, from one colony of Australia to another — thousands of miles in length—from one end of New Zealand to the other—and all through Canada. The gigantic efforts now contemplated a second time to span the Atlantic by a telegraphic cable, will if successful, connect the mother country with the outlying picket, if I may so say, of her American offspring. And while actually writing these sentences a telegraphic message comes from Bombay to London in a very few hours, and we have news from Melbourne in 28 days.

A whole evening might be advantageously devoted to the consideration of colonial railways—whether the Grand Trunk Railway, with its colossal bridge, and although perhaps born before its time, the true type of a main line, some 1,200 miles in length, running through and serving a whole country—or those spreading lines through every colony, joining towns and districts and annihilating distance—or those most important lines in India, enabling the produce of the interior to reach the shipping ports at a small charge, and, what is even more unexpected and astonishing, breaking down the distinctions of caste, all castes meeting on the common and neutral ground of the same railway carriage. The preceding statement of outlay on railways better expresses their importance than any observations our limits on this occasion will admit.

Machinery and the Fine Arts.—For machinery of all kinds our mechanical engineers find their most regular and profitable demand is for exportation to the colonies. Steam machinery of every description, agricultural implements, mill-work, guns, metal work, electro-metallurgy, and work in the precious metals, jewellery, watches, clocks, glass, and furniture of the more expensive kinds all find their more or less prominent place in our colonial export trade.

Transportation.

The objects of criminal treatment are twofold—to secure the community by deterring the evil-disposed, and to reform the fallen. In order to deter, punishments should be uniform, moderate, and certain, which unfortunately has not been the case with our English system, in which punishment has been irregularly and unequally inflicted in amount, and most uncertain in duration. This aspect of punishment concerns the criminal only so far as enabling him to speculate and rejoice at the chance of immunity; it is within the power of the free community to rectify these errors, and it is beyond our province to enter into that discussion; our subject regards transportation from the colonist's point of view. Many of our colonies were founded for penal purposes, and roads, public buildings, important clearings, and a great deal of most useful rough work, have been constructed and accomplished by convicts, farmed out to the settlers, receiving food and clothing in return for their labour, thus placing the free colonists in the position of enjoying the results of unpaid labour without the capital outlay for slaves. As emigrants increase, and colonies obtain the advantages of the competition of free labour, it is obvious that not only is the stigma of convictism disagreeable, but the free community of labourers will object to the presence of competitors of the tainted class. If, then, the colonies will not have our convicts, we must either let them loose at home under some sort of control, or keep them in confinement. Tickets of leave, in an old country, are sources of unmitigated evil, both to the free workman and the convict; if a convict is accepted to his prejudice, the former infers that virtue goes for nothing with employers, and those who may be required to work with ticket-of-leave men must either give up their employment or lower their tone of morals by associating at the same bench with convicted thieves and murderers. The convict also finds himself exposed to such a terrific competition that he seldom succeeds, and generally returns to his old courses. Must we, then, shut them up within four walls, with no society but that of their own sex, hardening and brutalising their already degraded being?—a treatment certainly not in accordance with man's nature, or the laws which are stamped upon the universe. By allowing a criminal to obtain a reduction of his term as the result of a seeming religious change, the doorway was opened to his being again let loose upon society, and this tempted him to become a hypocrite. The tendency of recently-improved legislation is to make him a suicide or a maniac. What hope can any man have who is doomed to be immured within prison walls for ten long years? It is a living death, or worse; and one of the most humanising instincts of man—the family—is altogether lost sight of. What do you propose to do with their wives? Will you release these wretched women from their marriage ties? And although a rigid law may say it has nothing to do with that, the instinct of nature echoing the law of God has something to do with this matter. As, then, man within four stone walls can have but little hope, and you thereby destroy the most softening influence of his nature, is there any other way by which you can equally as well secure the absence of the convict from society and yet not entirely destroy hope? All who have been in the colonies will recollect that, in the days of transportation, it was not at all an unfrequent occurrence for the wife of a convict to follow him; in many cases the husband was apportioned to his wife as her assigned servant, and circumstances being favourable, they frequently reached a respectable position to which they not only could never have had the slightest chance of attaining, but would probably never

* Through the Post-office alone remittances were sent in 1862 by settlers to their friends in Great Britain—From North America, £381,901; from Australia, £81,123.

have thought of attempting in the mother country. Many ticket-of-leave men would reform if they could, but they have not and never can have an opportunity for restoration in England; they have no honest mode of life open to them. What shall be done with them, then? The Falkland Islands appear to me suitable for the formation of a penal settlement. They are sparsely inhabited, escape would not be easy, and the climate is not severe. Some of the agricultural class of convicts might be allowed to settle upon small garden farms, and work out the payment by the produce; others might usefully employ themselves in those occupations which they might be previously taught in the home prisons, as tailoring, shoemaking, carpentry, blacksmithing, &c. Good behaviour for a term might entitle them to send for their wives, and thus some ray of hope of constructing a family be held out to them; and a face to face grapple with nature, albeit rough and stormy, would be more likely to improve and elevate the man, when brightened by hope, than the morbid influences of imprisonment.

Advantages of Colonization.

The surface of Great Britain being limited it follows that, as the population increases, the capacity of the land, if devoted to purely agricultural purposes, would soon be overtaken and eventually surpassed.

The needs of a large and increasing population can only then be met by increasing the non-agricultural proportion of those who remain in England and by transplanting others.

In 1861, the population per thousand appears to have been composed of

24	Professional.
574	Domestic.
31	Commercial.
101	Agricultural.
242	Industrial.
28	Not defined.
1,000	

It would seem, then, that as the quantity of land cannot be enlarged, the agricultural class must remain stationary in numbers or diminish, which latter is the more likely to be the case from the improved mechanical appliances brought into use for the cultivation of the soil, and it is within possibility that the industrial, which even now is more than double the agricultural, might eventually become too productive for the needs of its own limited community. The endeavour, therefore, of all sound statesmanship should be to adjust the demand to the production, and by such encouragement of emigration lead to the growth of purchasers in some measure proportionate to the necessary increase of manufactures.

Our colonies afford this plantation or nursery-ground for the growth of purchasers, the aggregate of the land available being, according to the table at page 414, practically unlimited, and the home deficiency of area is thus amply compensated by the extent of our colonial possessions. Another advantage of having so large an extent of acreage, in the form of colonies, is that the emigrants do not remove from the laws and manners to which they have been accustomed; they convey with them, and find on arrival, the same political, religious, and social thoughts and habits. Similar climate, area, and soil, would not be so advantageous, if the emigrants felt that they were going to a country under a despotic government, or one where the laws would be found to differ much from those of the land they had left. The tastes and habits of the emigrants having been acquired in England, they, to a great extent, lead to a demand for home productions for their gratification, a very important matter in a commercial point of view.

A third great advantage derived from the colonies is the sphere they afford for the prosecution of theoretical and practical science. And here multitudinous names, crowd upon the memory. One dare hardly individualise for fear that the very next moment the name of a second equally bright star may shoot across the sky.

Let me remind you how much we owe to Captain Cook pre-eminently, to Banks, and Solander, and that our most learned botanist, Robert Brown spent years in Australia; the speculative Darwin, whose views are shaking the scientific world, studied the coral reefs when out amongst the Australian colonies. The names of Beete Jukes, Logan, Bennett, Falconer, Hooker, and Huxley are symbols of legions of similar worthies, whose bold, broad philosophy has been to a great extent the result of the open eye due to the deep questioning of nature in her various forms in our new colonies. India opened out new fields for botanical research; Australia disclosed an entirely new series of animal life; and Canada has afforded a magnificent field to our geologists, the earliest form of animal life on our globe having been there recently discovered in a stratum far below that in which life had been previously observed.

And for practical science how vast the field. The marine of the country is employed and developed in the form of large emigrant vessels and coasters to the incredible extent of many millions of tons. Need I do more than call attention to the innumerable surveyors, engineers, architects, and educators who find ample scope and remuneration for their talents in the colonies. The surveys and canals of India, the railway and bridges of Canada, the road, harbour, dock, telegraph, and mill works in every latitude and longitude witness to the enlarged school of mechanical and engineering science fer which England has become the centre and eye of the world.

The late Sir George Cornewall Lewis, in his valuable essay on the Government of Dependencies, enumerates six advantages, or supposed advantages, which nations have thought they derived from colonies, viz.:—

1st. Tribute and revenue paid by the dependency.

2nd. Assistance for military or naval purposes furnished by the dependency.

3rd. Advantages from its trade with a dependency in the sense of a monopoly of special privileges.

4th. Facilities afforded by dependencies for the emigration of its surplus population, and an advantageous employment of its capital.

5th. Transportation of convicts to a dependency.

6th. Glory.

It will be seen from my preceding remarks that scarcely any of these are now of great importance to England as the dominant country. If any, her benefits are of a moral and intellectual character. I have named the extent of land, similarity of laws, sphere for the cultivation of theoretical and practical science, but I cannot pass over another advantage, as I regard it—I refer to the variety and quality of the openings for the studying and learning the art of government which our numerous colonies and dependencies present. Educated men from England depart from our shores to undertake the government or charge of millions of men scattered over all the earth, thousands of miles from the mother country—called to rule mixed races, to rely upon themselves, to raise armies if need be, to work upon, to countenance, to conciliate conflicting interests and passions; as dictators to decide for themselves on the moment, and with only the salutary moral fear of a distant English public opinion to check or control them beyond the high tone of their own character. And in this respect our colonies afford a magnificent school, highly beneficial to the colonies or dependencies, the mother country, and the world. Do we not all feel a tingle of proud satisfaction that men of the stamp of Hastings, Clive, Wellesley, Metcalfe, Elgin, Canning, and Lawrence should govern large portions of the human race, and that they are our countrymen, in many cases sprung from the ranks by the

native energy of their surpassing talents, which have raised them to the highest positions of fame and usefulness.

Disadvantages of Colonies to the Home Country.

The advantages we have named are not without drawbacks. Philosophers tell us that the effect of natural forces diminishes in far greater ratio than the mere distance from the centre of power, and history records that as nations or conquerors have attempted to rule over or conquer remote provinces the hold has ever been loose, difficult, transitory, and failing, generally felt to be oppressive by the province, always exhaustive of men and money to the dominant state. And wherever the governing power has either attempted to compel the inhabitants to render military service or to contribute by taxation to the needs of the central authority, the result has been the same, whether under Greek, Roman, Spanish, or English rule. Confining our thoughts to a slight survey of our own English position, we may observe that our army being small and derived from voluntary enlistment, the necessity of garrisoning so many colonies places us at a great disadvantage in carrying on any considerable military operations by land, whether at home or abroad. Had the whole English army been available for the Crimean war our national position in that affair would have been altogether different, both as regards allies and foes. Were the islands of Great Britain the only coasts we have to guard, our fleet would be amply sufficient, when at its least effective strength, to render us safe from attack; but the fleet, like the army, is scattered in detached fragments the world around—a frigate here—a liner there—thousands of miles apart. Not only do we suffer from the available force at home being so crippled in numbers, but the retention of colonies requires both our army and navy to be much more numerous and, therefore, more costly than if we had the home country only to defend, and this great expense (it, perhaps, would not be too much to say half the total) falls heavily on the English taxpayer. Our colonies present our most vulnerable point to an enemy, the attack can be concentrated upon any one spot, whereas the means of defence are widely scattered. Can anyone doubt for a moment that the unseemly language and overbearing conduct of the United States of America during so many years past have been entirely owing, not to any real cause of offence given by the people or the government of this country, but to the fact that we have one vulnerable place in the event of war with the Federal States. We should have the almost impossible task of defending a land frontier of twelve hundred miles in length which could be crossed at any spot by an invading army. Combinations of other naval powers could pounce upon some of our colonies and temporarily occupy and cause great distress to, if not permanently possess them, but in the case of Canada no sea voyage is necessary, we are exposed to the attacks of an ambitious people, now possessing a large army, the reabsorption of which into the ordinary occupations of life will require all the judgment of the governing powers.

It may be said that the Imperial Government can, by moderation, wisdom, and uprightness, prevent such a result, or at least so control its conduct, that, whatever may ensue, it will stand justified in the sight of the world. The danger, and the vast expense it causes, nevertheless exist, and Canada is a continual anxiety.

Thus far with reference to the danger we incur from other nations and governments on account of our colonies. In many cases, however, the home country has to bear the burden, wholly or in part, of local wars to which she has no inclination—wars entered into without her consent, contrary to her advice, and for purely local reasons and advantages, and out of which England—as England—can derive neither benefit nor honour. I refer to such wars as many of those we have had in India, at the Cape, and, at the present moment, in New Zealand. One or two sentences in reference to the last will put this subject in a clear light. That question has three aspects:—1st. The Imperial. 2nd. The Colonial. 3rd. The Native.

Before New Zealand became a colony, the Imperial Government entered into an arrangement with the natives, one item of which arrangement was that the natives should be allowed to keep their land if they chose, and neither be compelled to part with it by sale nor have it taken away. The Colonial Government cannot cancel the obligations of that treaty, whether wisely or unwisely made, but years subsequently to the arrangement, and after a constitution had been granted to the European part of the community, the anxiety to obtain land for speculative purposes (it cannot be for present settlement, because no one will contend that the land now owned by Europeans is brought under cultivation to anything like its full extent), caused the Colonial Government to purchase land from a chief who was *not* the rightful owner. When possession was refused, instead of pausing and inquiring into the merits of the case, a course suggested to the Local Government, by the Bishop and the Chief Justice on the spot, and by myself in England to the late Duke of Newcastle, the *wrong man's title* was supported by an armed force, and this I consider to have been the primary cause of the present war. After the arrival of the new Governor, the question of the title was investigated and the land *given up*, but bitter feelings had arisen, revenge and all the bad passions which murder, robbery, and burning create, had by this time taken deep root and extended. And England has had to pay some millions of money for a war incurred chiefly about this miserable squabble respecting 600 acres of land.

I name this one case to show our liability to incur enormous expense for the sake of our colonies. However right or wrong they may be, we must stand by them even in their local wars. The Colonial Government may say, "Let us alone and we will settle our own local difficulties," but they should also recollect that the Home Government cannot always allow such license, its own word and arrangements have some claim to be upheld, and in the present instance the local government was not in existence when the bargain was made; the arrangement was made direct with the Queen's representative, and the government of the natives has always been excluded from colonial control.

Again, at one period, when this country could send its convicts almost whithersoever it preferred, when our home manufacturers were highly favoured against foreign productions, when we had the monopoly of colonial shipping and carrying trade—selfishness might have induced us to retain our colonies with a pertinacity comparable to the vigour with which we had obtained them. But now, when they are placed upon the same basis as ourselves, in reference to trade; when perfect freedom exists in all or nearly all of our colonies; nay, when some of them are contemplating and even enacting protective duties against the home country, I must boldly say that our liabilities on their account are so great, that whenever any one of our colonies, or all, are disposed to separate from the mother country, and are no longer desirous of sheltering themselves under the parental roof, but, like grown up sons and daughters, are ambitious to settle for themselves, I should cheerfully assent, wishing them all success and God-speed.

Separation from the Mother Country.

This brings me to inquire whether the colonists themselves desire to withdraw from the government of the home country? I believe they all desire to retain their connection with the home country. However free and unbecoming may be the language of some of the colonies towards the home government, occasionally amounting almost to insolence, yet looking at the matter broadly and over a lengthened period, it must be unhesitatingly asserted that there is not at the present moment a single colony at all desirous of throwing off allegiance to the home country. Two or three reasons, out

of many which might be given for this satisfaction, may be named. First, for the most part the colonists have had large and liberal constitutions granted to them, whereby each colony is empowered to make its own laws, raise its revenue in the form most agreeable to itself, an act which it sometimes does very much to the prejudice of the home country—in fact, with few exceptions, to govern itself as independently as if it were a distinct nation. Not only so, but they possess the additional advantage of bearing but a comparatively small share of the cost of their own defence, and have the most powerful maritime nation in the world committed to their protection. And it is scarcely too much to assert that if the flag of England were hauled down and ceased to wave over our colonial possessions, the smaller ones would most certainly, and the larger ones very probably, soon fall a prey to less lenient control than the British. Again, consider the rate at which the several colonies borrow money for their local improvements. The direct monetary advantage of the guarantee of the home government is very considerable, or it would not be so eagerly sought. Even without that, a British colony comes into the money market with confidence, and secures loans on terms which most foreign countries would be extremely glad to obtain.

There is another matter, which the better class of colonists deem of great importance in a social point of view. If detached from the old country they would probably, almost necessarily, form republics, and have all the burning heats of violent political partisanship, presidential elections, &c., and take their whole tone of society from the narrow limits of a small population, the key-note of public feeling, sentiment, and manners being struck from the uneducated mass, working from below, if I may so speak, upwards. Quite apart from all questions of dependence and monetary and material advantages or disadvantages of a connection with the mother country, the best class of colonists value this connection for reasons which may be thus stated:—Nominated by her Majesty, who is too elevated by her position to have any other motive than the welfare of the colonial community, the authority of her appointed governor unembarrassed by local ties or influences, fresh to the colony, and generally a man of superior education and knowledge of the world, accompanied by an accomplished wife, a lady by manners and birth; the prestige of a bishop and clergy carrying to a greater or less extent profound respect for the learning of Oxford and Cambridge to the uttermost corners of the earth; the presence of military officers, the mild excitement of the inspection of the few troops stationed in most of the colonies, the periodical playing of the military bands, enlivening the otherwise dull business existence and softening the rude competition of the majority of the settlers—all these the colonists feel tend to raise the tone and give an old-home air to colonial society. Again, the visits of our men-of-war are always looked forward to with pleasure, even the solemn magisterial office regarding the escapades of Jack ashore with a very lenient eye; and the youngest and most mischievous middy who can display her Majesty's button may safely reckon upon finding a hearty welcome in every settler's home, whether the veriest log-hut or of palatial pretensions. Many military and naval officers form such associations and attachments in the colonies in which they may have been temporaily located that they eventually retire from active service and become settlers; and so much are they desired as colonists that special advantages are generally offered to settlers who may have belonged to her Majesty's service. Now, all must admit that the presence of a small court, if we may so term it, comprised of the elements we have named, is very advantageous to a colony; and I venture to assert that this class of advantages more than the pecuniary benefits arising from the presence of government, induce those violent contests for the honour of being the capital, which we see exhibited in every colony. Witness the dispute as to whether Montreal, Toronto, or Ottawa should be the capital of Canada, and the pertinacity with which the rival claims of Auckland, Wellington, Nelson, and Marlborough have been put forward for the honour of being the capital of New Zealand; the same may be said of Calcutta, which otherwise would certainly not long remain at the present day the capital of India.

CONFEDERATION.

I now venture to offer a few remarks on a subject which is becoming important, inasmuch as the results of the discussion now going on will affect, for good or evil, large territories of the globe, and millions of its inhabitants, of English blood, speaking our language, and retaining more or less the habits and love of the old country, and in whose destinies we cannot but feel a great interest. Colonies are first formed by a small settlement being made on the coast of some newly-discovered island or continent, and distance from the mother country necessitates the speedy establishment of a government, if such has not been previously arranged before the departure of the colonists. As the straggling colonists, with their innate love of wandering, proceed further and further from the primary settlement, often leaving large unoccupied gaps between the settled districts, it becomes advisable to have a second and a third focus of government, in order to bring these scattered populations under control. Hence boundaries, separate governors, legislatures, and revenue laws, applicable to the peculiar needs of each community. In process of time these communities, becoming more numerous, approach and touch each other, and that which formerly was a necessity for separate colonial legislation becomes incidentally followed by inconveniences. Local jurisdiction, difference of revenue duties, weaknesses from dissension, all occasion difficulties and disputes. From this cause, and more particularly from the threatening language of the government of the Federal States of North America, this question of the federation of colonies, has recently been revived. Time does not permit us to discuss this matter largely, but it may suffice to point out a few of the main principles which should guide the establishment of a federation.

1st. Equitable adjustment of taxation and duties, internal and external, for revenue purposes, that there may be no inducements to smuggling and fraud, and the expense of frontier custom-houses, watchmen, or coast-guards may be rendered unnecessary.

2nd. One system of monetary regulations, currency, coinage, and banking laws.

3rd. Uniform criminal and commercial laws.

4th. General application of loans for public works, and combined naval and military defences.

The disadvantages of confederation of this kind are to be found in the comparatively greater attention which would be given to general, rather than to the individual or local interests of the separate districts or provinces, and the subordination of the local governments to the central authority, the consequent diminished importance of the provincial councils and capitals, the swallowing up of the local in the central, and the want of recognition of those peculiar advantages, which each small colony believes itself in a position to offer to the intending settler. On the other hand the advantages are manifold. All border disputes about taxation and revenue would entirely cease. Is it not absurd, for instance, that goods imported into South Australia should pay one rate of duty, and through Victoria another, and that the running of customable goods across the border of adjoining colonies should be a source of profit to the unscrupulous, attended at the same time with great expense to the colony more highly taxing any given article, in order, by customs' stations on the frontier line, to protect its revenue. Again, unseemly quarrels about postal service, as between Victoria and New South Wales, would be avoided or overruled, as the general government would not be likely to have local preferences. As each district, from its

TABLE SHOWING THE DATE OF ACQUISITION, AREA, POPULATION, DEBT, AND TRADE OF THE BRITISH DEPENDENCIES AND COLONIES.

Name of Colony or Dependency.	Date of acquisition or settlement.	Mode of Acquisition or Settlement.	Area in square miles.	Total Population.	Public Debt.	Rate of Interest.	Shipping. Entered. Vessels.	Shipping. Entered. Tons.	Shipping. Cleared. Vessels.	Shipping. Cleared. Tons.	Import Value.	Export Value.	Special Trade.
						per cent.							
India—Presidency of Bengal.	...	Originally a Company of trading merchants, formed in 1599. The East India Company was formed and chartered in 1708, and, after several renewals of the charter, the trade has of late years been thrown entirely open and the political power of the Company withdrawn, the government of India being now vested in a Council, at the head of which is a Secretary of State.	261,380	40,466,690	...	...	...	...	...	...	14,307,358	13,110,859	Cotton. Sugar. Rice. Indigo. Teak.
,, Oude	...		27,890	8,071,075	...	...	...	...	...	...	...	...	
,, Central Provinces	...		108,660	7,041,480	...	...	..	...	...	...	...	...	
,, British Burmah	...		90,070	1,897,897	...	...	...	...	...	...	533,790	1,425,871	
,, N. W. Provinces	...		86,380	29,624,462	...	...	...	...	..	...	...	...	
,, Madras	...		140,917	23,180,323	...	...	...	...	...	...	3,474,519	3,413,634	
,, Bombay	...		142,043	12,802,544	...	...	...	...	...	...	18,956,750	19,050,033	
,, Punjaub	...		100,406	14,794,611	...	...	...	...	...	...	...	...	
,, Under the Governor-Gen. of India	...	Territory from time to time enlarged by invasion and annexation.	46,870	5,392,128	107,514,159	..	944	559,568	1,174	572,401	...	...	
											37,272,417	37,000,397	
Canada, Upper / ,, Lower	1759	Capitulation to General Wolfe	210,020	1,396,091 / 1,111,566	14,148,418	4 to 8	...	5,022,625	...	4,859,018	10,125,132	6,399,102	Timber.
New Brunswick	1763	Ceded by France	27,037	252,047	1,148,055	5 to 6	3,175	561,763	2,969	586,973	1,291,604	803,445	Shipbuilding.
Nova Scotia	1713	Ceded by France	18,671	330,857	982,538	4 to 6	6,111	663,047	5,863	690,207	1,689,008	1,129,392	Shipbuilding.
Prince Edward's Island	1758	Taken from the French	2,173	80,857	65,922	5 and 6	1,076	69,080	1,095	81,208	211,241	150,549	
Newfoundland	1713	Treaty of Utrecht	40,200	122,838	173,643	$4\frac{3}{4}$ to 6	1,345	160,075	1,159	147,237	1,007,082	1,171,723	Fisheries.
British Columbia (not including Vancouver's Island)	1858	Separated from Hudson's Bay territory	200,000	4,296	91,730	6	276	63,959	255	64,162	560,168	12,277	
Vancouver's Island	1859	Erected into a Colony	16,000	...	...	...	...	...	...	...	758,623	...	
Bermuda	1609	Colonised by Sir G. Somers	24	11,451	...	...	314	81,186	308	79,091	238,933	40,415	
Honduras	1786	Treaty with Spain	13,500	25,635	...	...	115	33,600	103	31,808	211,358	356,390	Mahogany.
West Indies—Bahamas	1783	Treaty of Versailles	2,921	35,487	43,487	$4\frac{3}{4}$ to 6	694	107,446	718	99,862	1,250,322	1,207,755	Sugar.
,, Turk's Islands and Caicos	1848	Separated from Bahamas	...	4,372	900	5	452	57,521	484	58,792	35,956	32,715	
,, Jamaica	1655	Captured from Spain	6,400	441,264	766,182	4 to 10	506	112,642	523	117,474	1,141,984	1,113,442	Sugar, Rum.
,, Virgin Islands (Tortola)	1666	... ...	57	6,051	...	...	1,207	3,734	1,274	3,761	7,724	15,708	
,, St. Christopher	...	... ...	103	24,303	...	...	662	29,868	654	29,010	166,872	175,958	Sugar.
,, Nevis	1628	Colonised by English	50	9,822	4,600	3 to 6	165	8,533	167	8,484	31,125	42,869	Sugar.
,, Antigua (including Barbuda)	1666	Ceded by France	183	37,125	30,320	1 to 6	540	31,710	540	29,705	186,353	226,328	Sugar.
,, Montserrat	1784	Cession	47	7,645	5,362	$3\frac{1}{4}$	159	6,890	153	6,950	22,387	14,882	Sugar.
,, Dominica	1783	Ceded by France	291	25,666	6,972	$6\frac{7}{8}$	284	9,321	288	8,912	60,592	94,291	Sugar.
,, St. Lucia	1803	Capitulation	250	27,480	18,000	4	172	11,037	178	10,841	93,607	87,992	Sugar.
,, St. Vincent	1757	Ceded by France	131	31,755	...	...	331	15,706	291	15,040	140,289	143,323	Sugar.
,, Barbadoes	1625	Colonised by English	166	152,727	...	...	1,132	116,113	1,125	115,490	913,142	1,067,613	Sugar.
,, Grenada	1783	Treaty of Versailles	133	32,984	12,000	4 and 6	353	19,393	390	19,644	112,519	87,861	Sugar.
,, Tobago	1803	Conquered by Hood	97	15,410	5,462	$3\frac{1}{4}$	87	7,462	87	7,093	55,375	75,428	Sugar, Rum.
,, Trinidad	1797	Taken from Spain	1,754	84,438	255,473	4 and 6	793	114,736	781	108,346	733,599	739,507	Sugar.
,, British Guiana	1802	Taken from the Dutch	76,000	155,026	563,700	4 to 6	698	150,014	690	133,652	1,107,181	1,365,295	Sugar.
Falkland Islands	1833	Possession taken by England	7,600	624	...	...	63	34,438	62	35,306	25,532	15,556	
Australia—New South Wales	1770	Exploration by Cook	323,437	367,495	5,802,980	5	1,493	454,837	1,568	467,356	9,334,645	7,102,562	Wool, Gold.
,, Victoria	1851	Separated from N. S. Wales	86,831	573,941	7,992,740	5 and 6	1,715	556,188	1,766	581,892	13,487,787	13,039,422	Wool, Gold.
,, South Australia	1836	Colonised by a Company	383,328	135,329	853,300	6	396	108,866	415	115,939	1,820,656	2,145,796	Wool.
,, Western do.	1829	Settlement	978,000	17,246	1,750	6	105	54,471	103	50,455	172,992	119,314	Wool.
,, Tasmania	1803	As a Penal Settlement	26,215	90,728	486,500	...	734	107,664	754	108,915	857,423	919,649	Wool, Corn.

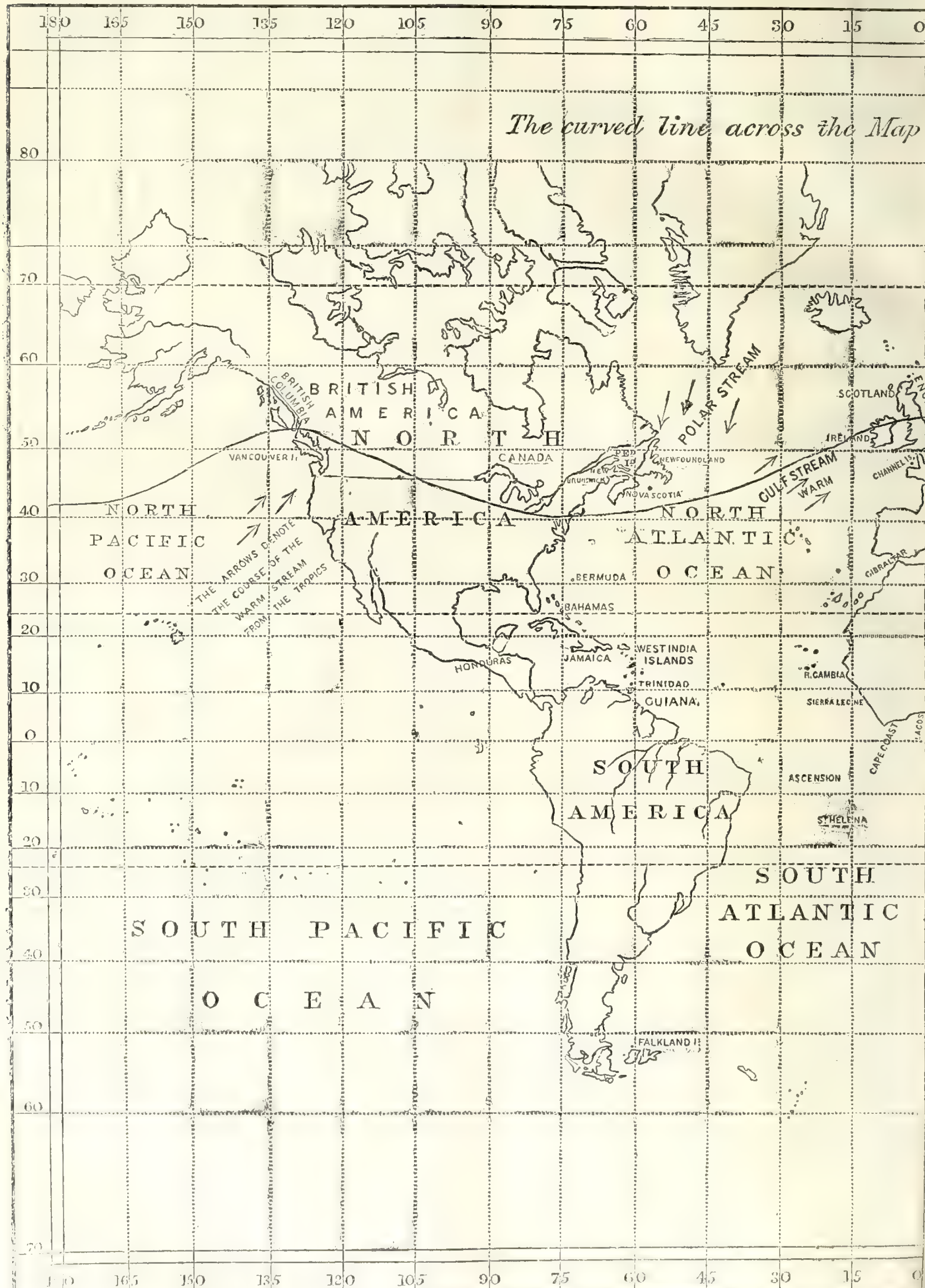
Name of Colony or Dependency.	Date of acquisition or settlement.	Mode of Acquisition or Settlement.	Area in square miles.	Total Population.	Public Debt.	Rate of Interest.	Shipping. Entered. Vessels.	Shipping. Entered. Tons.	Shipping. Cleared. Vessels.	Shipping. Cleared. Tons.	Import Value.	Export Value.	Special Trade.
New Zealand	1840	Proclaimed a Colony	106,259	106,315	1,600,000	4 and 6	813	301,356	783	288,647	4,626,082	2,422,734	Wool.
Queensland	1859	Separated from N. S. Wales.	678,000	45,077	123,800	6	330	77,312	305	71,981	1,323,509	746,448	Wool.
Hong Kong	1841	Treaty with China	29	123,511	...	...	1,390	688,829	1,330	655,281	..	...	
Labuan	1846	Ceded by the Sultan of Bruni	45	3,345	...	...	17	4,875	17	5,299	42,774	13,122	Coal.
Ceylon	1795	Taken from the Dutch	24,700	2,219,507	...	...	2,788	447,481	2,791	441,511	4,243,140	2,494,120	Coffee.
Mauritius	1810	Captured from the French	708	322,517	...	...	663	274,255	679	284,388	2,438,412	2,517,288	Sugar.
Natal	1843	Proclamation after submission of the Boers	14,397	340,000	50,000	6	96	22,948	95	21,479	449,469	127,228	Sugar, Wool.
Cape of Good Hope	1806	Taken from the Dutch	104,931	267,096	565,050	6	1,044	363,537	1,053	369,183	2,785,853	1,957,686	Wool, Wine.
St. Helena	1673	Taken from the Dutch	47	6,860	...	...	249	139,860	48	19,920	137,938	16,186	
Gold Coast	1750	African Company Act of Parliament	6,000	400,000	...	...	87	20,877	87	20,877	162,970	145,819	
Sierra Leone	1787	Ceded by Native Chiefs	468	41,860	...	...	373	43,352	386	45,662	144,269	268,815	
Gambia	1588	Patent to a Company by Queen Elizabeth	20	6,939	...	...	176	40,788	182	38,897	99,825	154,443	Ground Nuts.
Gibraltar	1704	Taken by Sir G. Rooke	$1\frac{2}{3}$	16,643	...	...	4,279	1,076,813	4,265	1,077,629	2,473,999	2,556,527	
Malta	1800	Surrendered by the French	115	143,970	161,551	2 and $2\frac{1}{2}$	3,058	418,049	3,062	418,409	3,697,574	2,990,558	
British Kaffraria	1860	Separated from Cape Colony.	...	87,182	...	...	15	1,827	12	1,201	...	...	
Bulama	1792	Cession, dependent upon Sierra Leone	...	..	..	...	...	..	...	...	250,000	239,720	
Lagos	1862	Royal Commission	...	...	...	...	...	...	...	...	77,933	61,932	
Heligoland	1807	Captured from Denmark	...	2,172	...	...	...	...	...	...	...	...	
Seychelles and Rodigues	...	Dependencies of Mauritius	...	...	...	..	...	...	...	...	...	...	
Hudson's Bay	...	... ...	...	...	...	...	...	...	...	...	...	...	

geographical position, animal, vegetable, or mineral resources, necessarily varies in its peculiar requirements and the inducements it offers to emigrants, so it may be laid down that, subordinate to certain general principles and laws, which should include the fewest subjects possible, and be as clearly defined as practicable, the separate provinces or colonies should possess all the freedom of legislation and action compatible with the general good. It is evident that a fishing, a timber, a corn, and a sheep-farming colony may and must have very different modes of regarding the laws which should govern its taxation, its offers of land to emigrants, and the constituent elements of its general prosperity.

It would seem therefore that federation may more easily be longitudinal than latitudinal, climate having so much more influence on the welfare and social habits of human beings than at first sight we are apt to suppose. A tax upon wool, for instance, which would be oppressive at one extremity of a confederation, 1000 miles in length latitudinally, and almost unfelt at the other, might be an equally felt burthen in a confederation of 1000 miles length longitudinally. Whether this be a precisely correct view in every case or not, certain it is that, without permanent and close similarity of interest, confederation would be difficult, very probably not advisable. The excitement of a common danger is a very ephemeral bond; and the moment the fear of the threatened danger ceases, the chafing of the bond is inconveniently felt. In the last century the common cause of severing from England, united the several colonies of America, against the mother country; but the danger of the anticipated punishment for rebellion having ceased, the difference of internal interests is causing the most ferocious war on record.

The confederation of several colonies for purposes of defence in case of invasion is doubtless very desirable. Conquest is not the result of an invading force being able suddenly and momentarily to overrun a country, for however disastrous to the peaceful inhabitants such a visitation always is, this curse may be only temporary, and the marauding wave be eventually driven back. It is most important for security against such inroads, to check their progress if attempted, or to recover lost ground, that strong positions, either presented by natural advantages of situation, or arising from scientific constructions, should be judiciously selected, capable of offering stubborn resistance to the invader, and regarded as barriers or nuclei, behind and into which the militia, volunteers, and small military force of the mother country, to which every colony at the outbreak of war must necessarily be limited, may resort, and there make a resolute and permanent stand until their compatriots may have time to rally, and adequate assistance be rendered by the old country. In other cases these defences would probably consist of gunboats, dykes, moats, and canals, water impediments to the enemy. Plans of this kind can evidently be more advantageously and successfully carried out, the larger the population contributing such mutual assistance, and the greater the area for selection of good defence points. The rallying forts or entrenched camps would be comparatively fewer, but much stronger and more imposing to the invader than if each colony, island, or province had to rely upon itself unaided; and the naval and military combinations would be more effective and likely to secure the general result—the common defence. In this sense the union of several colonies is much to be encouraged. I do not at all agree with the idea that because Canada is not a desirable seat of war for England, therefore no attempt should be made at defence. Our being at a disadvantage there is a circumstance we cannot avoid, and must accept as we find. We should, of course, not select it as our field of battle, but when we know it is our weakest place, of which the enemy would be sure to avail himself, I read neither English history nor the national characteristics aright if I could believe for one moment that we would expose some three or four millions of our fellow subjects to the tender mercies of an army under such

SKETCH MAP, SHOWING THE COLONIES



It will be observed that the West Coasts of both Europe and North America are warmer than the East Coasts, and latitude of their position. The average temperature of London is about the same as that of Philadelphia, which

AND DEPENDENCIES OF GREAT BRITAIN.

also that the British Islands, British Columbia, and Vancouver's Island, are much warmer than is due to the mere is 14° further south; and the St. Lawrence, which is south of the Thames, is frozen over several months every year.

a man as Butler, without aiding them to make the best attempt at local resistance possible under the circumstances.

The question of colonial defence appears to be composed of three elements—mode of defence—expense—men. It would seem that the particular mode of defence in any given case must be left to the professional scientific advisers of the Crown and the colonies, with the understanding that the object is not for an English army or navy so much as for the local force. The expense of the permanent works in any given case should be borne by the colony, as it would be incurred for its special benefit, and the money would be spent among its population; but as any war to which the colonies might be exposed might be caused by imperial considerations, there would be little objection to the home government guaranteeing the interest. As the armament could be better provided, so that expense might be borne, by the home government, which would have control over its disposal and removal. Colonists should recollect that England is safe from attack; that we incur large expenses both of money and time on their behalf; money in taxes for the support of an army and navy principally employed in their defence, and time in large numbers of our people learning drill and the duties of soldiers, that we may allow our regular troops to be distributed all over the world. As to the men, no binding rule can be laid down; the number of the imperial forces must depend at all times upon its other needs; as a general principle the home force permanently located in any one colony could only be very small. Our colonies have been freed from control; their legislation is seldom advantageous, often adverse, to the mother country, and they must learn to bear the pecuniary burden of their own local defence.

CONCLUSION.

Upon the great empire which is presided over by our sovereign lady Queen Victoria, the sun ever shines; and as the morning gun boometh in a thousand ports, our pleasant red ensign floats out in the bright sunlight, greeted with a home thrill which only the emigrant exile can feel, for under its protection thought, speech, and action are free as the breathing wind which flutters through its wavy folds. At its sight ever the morning prayer or evening blessing welleth up in the hearts of English men and women, encircling the earth in one bond of union, freedom, and progress, for after the longest lapse of years, the look is still to Old England as their home. Shall the freedom we enjoy, and which, by our colonial empire, is spreading throughout the world, be curtailed and shorn of its proportions, or shall we, faithful to our high trust, diffuse throughout the world the liberty which our forefathers died to achieve, and with our privilege accept its responsibilities? We think our countrymen will give but one emphatic answer to the question; and while our colonial brothers desire to remain under the mild rule of our widowed Queen, they will ever find their English friends willing to stand with them shoulder to shoulder on their behalf, ready for quiet victory or silent death.

DISCUSSION.

The CHAIRMAN, before inviting discussion on this interesting and important subject, would make a few observations upon the singularly valuable paper which they had just heard. Mr. Stones had observed that he had purposely abstained from saying anything about ancient colonization; but, from the very able character of the paper throughout, he (the Chairman) could have wished that subject had been treated of, because it was one of the most interesting in the world. All we have in taste, in art, in beauty, in poetry, and in philosophy, came from the Greek colonies, which had led to the foundation of Rome. This subject was peculiarly interesting to ourselves, inasmuch as it would seem to have been our mission to conquer the dusky nations of the east, and to people the lands of the fertile south with a race of hardy islanders. He, therefore, quite agreed with the sentiments expressed by Mr. Stones with regard to emigration, of which it might truly be said that "it blesseth him that gives and him that takes." A farmer in Wiltshire had lately stated to him that he remembered the time when the labourer considered himself well paid with the price of a bushel of wheat for his wages; he was now paid the price of two bushels, thus showing the effects of emigration upon the welfare of those who remained at home. He quite agreed that emigrants should be men who could do hard work—professional men were not so much wanted. With regard to the supply of raw materials from our colonies, he could only say this—that in the late dearth of cotton we had searched the world through for supplies of that material. The magnificent empire of the Brazils; the south of China, containing the most industrious population in the world; the valleys of the Tigris and Euphrates had together given us but little; but from our old dependency of India we had obtained about four-fifths of our recent supply. This showed how important an influence British rule exercised in promoting the supply of such raw materials as we required. He differed from the author of the paper in his idea that mechanical contrivances would have the effect of making labour cheaper. He saw before him an honourable friend (Mr. Bazley) who had a great deal to do with mechanical contrivances, and he was sure he would confirm the statement that the more mechanical contrivances thrived the more they tended to make labour dear. With machinery a man worked with the fingers of a giant, and was consequently better paid than if he did the work with his own hands, as the production was so much greater. In fact, mechanical contrivances ultimately tended to raise wages. With regard to the danger of foreign attacks upon our distant colonies, no doubt that danger was increased in proportion to the spread of civilization over the world. It was thus rendered necessary for the mother country to maintain enormous armaments and fleets for the protection of the interests of her colonies, but these also afforded us the means of making effective reprisals in case of an attack on any of our dependencies. If the French were to assail our West Indian colonies we could bombard Brest, or some other seaport, in return; therefore it was not probable they would do this, because the retribution would be greater than any injury they could inflict upon our distant colonies. There were in the paper some very striking remarks with respect to the extraordinary feeling of brotherhood produced by political and commercial connection. It would seem that in the present day, when the principles of free-trade prevailed, there would be no advantage in this political connection, but the contrary was the fact. Take for instance the Cape of Good Hope, which was perhaps rather an ill-favoured colony. We gave up Java and Sumatra to the Dutch and kept the Cape, and it was a remarkable fact that our exports to the Cape were now five times what they were to Java and Sumatra. No doubt if the political connection of this country with those islands had been maintained, the exports would have been much larger. Take again the instance of the Mauritius—a beautiful little island, not larger than the Isle of Wight. The exports from this country to that small colony were more than ten times as extensive as those to the great country of Mexico; three times as great as those to Moldavia and Wallachia; and twenty times as great as those to Persia. Then take India—the exports to that country were twenty millions annually, whereas to China, with a large population—more industrious though less frugal—the exports were only five millions. If we were in possession of China as we were of India, our exports to that country would probably amount to one hundred millions per annum. These were some of the leading advantages of our colonial possessions. The paper referred to another subject of importance—that was the granting of free institutions to our

colonies. He was afraid that in that we had been somewhat precipitate. It was done no doubt with the best intentions, but it had launched some of those infant communities into the wildest democracy the world had ever seen, and had given rise to forms of government which the most advanced liberal would tremble to see introduced into the old country. He agreed with what Mr. Stones had said on the subject of transportation. It was impossible, in the present state of society, to keep people immured in gaols for any very lengthened periods. Imprisonment for life, or even for ten or fifteen years, was unendurable to the worst of criminals, and transportation somewhere appeared to be desirable upon all considerations. He had seen the working of the system in the Australian colonies, and he could assure them that under the old plan, which was after all not particularly well carried out, the best results were produced. The Falkland Islands had been suggested as a locality for the transportation of criminals, and in that suggestion he concurred. It was a very windy place, where it was said "the hair was blown off one's head," but perhaps that was a climatic condition good enough for convicts. With regard to confederation, however desirable that might be, there were difficulties in the way of it, though not perhaps insuperable. We lived in times when we had seen the great American Confederation broken up; they never could be friends again, whatever happened; and this showed that in any confederation of the Canadas and other colonies there would be great difficulties. With regard to what had been said as to the cost of maintaining the naval protection of our colonies, they must remember that our navy required arsenals all over the world; and these must be furnished whether we had colonies or not. It must not be forgotten that our commerce every year amounted to nearly six hundred millions, including the carrying trade. The maintenance of our navy cost ten millions per annum, and if it were for nothing else than for the protection of our commerce on the seas this would be but a small per-centage upon the whole.

Professor Leone Levi said—Proud as this country might be in having given birth to so many communities, some of which had already become incipient empires, proud as she might be in possessing a territory so vast, a population so extensive, and resources so great as had been so vividly described this evening, there were causes in operation which were likely to lessen materially the need of possessing such colonies, and which would render the possible separation of any of them a matter of much less solicitude than would have been imagined some years ago. What were the principal benefits supposed to be derived from the colonial system? Practically three only: a large field for emigration; an extension of trade, with facilities for the investment of capital; and political strength and influence. Much was said of the field afforded by colonies for emigration. He could well conceive that in times gone by, when countries knew each other only by their armed forces, when there was no protection beyond what could be obtained by the national flag and national power, it became necessary for our redundant population to found colonies where they might establish themselves in safety. When war was the normal state of international relations no one could risk himself in the dominions of other countries. But the times were now, happily, quite changed in this respect. Now that peace was the rule and war only the exception; now that international law and public law reign supreme everywhere, there was no longer the necessity of seeking the shield of British protection within the national territory. Our emigrants were, in fact, but little affected by such national considerations. Take the emigrants for 1862 to the United States and British North America. One was foreign, the other British. Yet 59,000 went to the one and only 15,000 to the other. No doubt a common language, common laws, common manners, would always be important considerations for an emigrant in the choice of a country, but even those elements were now greatly modified by the constant merging of nationalities, by the greater assimilation of manners, the better knowledge of languages, and the greater charity which obtained everywhere for the foreigner. Secondly, as to commerce it was admitted that a third of our entire trade was now carried on with the colonies, and that more than half of the entire trade of the colonies was carried on with the United Kingdom. This showed that as the colonies were of great importance to the United Kingdom, so the United Kingdom was of the greatest importance to the colonies, but that did not depend on the present relation of the colonies to the mother country. It only evidenced, on the one hand, the capacity of these territories to produce articles of great and universal value, and on the other, the capacity of the United Kingdom, as the largest market of the world, to attract such produce to its shores. In the present state of our colonial legislation the colonies were no longer bound to send their produce to this country. They sent it because they got here the highest price for it. They sent it because they were sure of a market. They sent it because they were greatly indebted to this country for the manufactures they purchased and for the capital Britain invested in them. He admitted the fact that such colonies were of great value to our trade, that they supplied us with articles absolutely necessary for our consumption and for our manufactures, that they consumed a large amount of British goods, greater of course than other communities; but he doubted whether this was because they were our colonies. It was simply because they followed the natural laws of trade. As for the investment of capital, he had yet to learn what guarantees were afforded in any of our colonies greater than were obtainable in other countries. The advantage they possessed was that they had virgin soil to work upon and infant communities offering the most brilliant prospects of increase. But that resulted from circumstances natural to the territories themselves, their soil, their climate, and their power of production. The third prominent advantage which colonies seemed to confer was strength. But, ignorant as he was of the art of war, he certainly scarcely thought that, in a strategic point of view, our colonies were not of any great value, at least the greater number of them. They were rather calculated to scatter our forces, to divert our attention, and to weaken our power of offence and defence on the high seas, where, after all, the great conflict of nations was decided. He would not enlarge on this point, since persons of greater practical knowledge might be ready to disprove any such consideration. Yet it was a question of importance to consider whether our colonies were really imparting strength to the empire or not. Time, indeed, was when the extension of territory was considered a primary condition of political influence, but we know now that the larger the territory the more difficult it was to govern. Look at Russia, how hard it was for the central government effectually to rule the extremities. And what did we experience ourselves? Could we govern India from this country? Could we govern Australia? It would be morally impossible. Most of our colonies were, in fact, self-governed; in some all authority was left in the hands of the governor, legislating alone or with a consultative council; in some the power was in the hands of the legislative council, partly nominated and partly elected; and in other cases the authority was entrusted to an elective council and an elective assembly; but in each case very little power was vested either in the Secretary of State or in the Queen herself. There was, no doubt, much glory in the name of possessing countries so great, but as to any attempt to direct the government of them, it must be renounced altogether. If, therefore, no great practical advantages arose from the present bond of colonial relationship, we might be quite sure that the time would soon come when questions of separation would force themselves on our attention, whether they were pro-

voked by the colonies themselves, or by thoughts of rigid economy, or otherwise. An evidence of the altered state of public opinion on this subject was given in the cession of the Ionian Islands. Some twenty years ago it would have appeared sheer madness to have parted with such colonies in an important position in the Mediterranean. Now they were abandoned without a sigh. It would, perhaps, be said that this was only another manifestation of the grovelling spirit of the age, but, in truth, it was the result of a great change in the prevailing opinion as to the real sources of national strength and prosperity. What would further facilitate this impending separation, would be the confederations now negotiated. It would never be possible to abandon these infant communities to themselves so long as they were isolated, but let them associate themselves into great federations, and they would be able to stand their ground, and to place themselves firmly under the protection of public and international law. What we should do was to render these federations as complete as possible; and he was glad to find in Mr. Stones' paper some valuable suggestions in this respect. What they certainly should aim at was an equitable adjustment of taxation and duties founded on the dictates of economic science. It was a disgrace that any of them should resort to protective export duties after the mother country had taught them better things. If any country should be able to experiment on the working of a complete free-trade system, it should be our colonies with their small expenditure and their thriving population. They certainly should have one system of monetary regulations, currency, coinage, and banking laws, and they should have a uniform criminal and commercial law. We were lamenting the differences between the laws of Scotland and England. But what were these differences to those arising from a completely different system, some colonies having Dutch, some French, and some Spanish laws, setting aside India with its Hindoo, Mahometan, and Parsee laws. These were practical difficulties which we should endeavour to remove. It certainly appeared that some of our colonies, such as Canada and Australia, had reached the state of manhood; and it depended very much on themselves to determine what kind of relation they would continue to hold with the mother country. Britain had certainly fostered them in their infancy, and watched their growth with all the solicitude of a parent, and should they now desire to part, it would become her duty to regard them, not with jealousy, but with sympathy, and to act towards them, if not with patronage and fatherly interest, at least with brotherly affection and brotherly encouragement.

Mr. Torrens said, while he agreed with all that had been said in the paper with regard to the advantages derived by the mother country and by the colonies from mutual connection and from emigration, he entirely dissented from what had been said with respect to the counter-balancing disadvantages of that connection. He had the best opportunities of forming sound opinions on this subject, having early in life emigrated to a new country, now highly prosperous. He referred to South Australia, where he had filled the office of Commissioner of Trade and Customs. He joined issue with the author of the paper on the statement that our colonies were exhaustive to the mother country in men and money. On that point he thought the paper answered itself, because, in the early part of it, Mr. Stones dwelt appropriately upon the great increase of the wealth of the mother country, occasioned by the demand for her productions by her sons transplanted into countries where they were more adequately rewarded for their labour. By that means they were enabled to consume a larger amount of British manufactures than if they had remained at home. It would be found that in the Australian colonies the average consumption of British manufactures throughout the entire population was £8 per head per annum. They knew that no labourer in this country consumed anything like that; but by sending a portion of the surplus labour of the country to our colonies they enabled a larger population to subsist at home. Thus he maintained that colonization was not exhaustive to the mother country in men; far less was it exhaustive in money. If they looked around them in this great city they found those who had acquired wealth in the colonies spending that wealth in this city, besides which, there was the increased wealth derived by this country from the demand for our manufactures by the populations of the colonies. The next point alluded to as being regarded as a drawback was the cost of protecting the colonies, and that whilst that expense fell upon the mother country the colonists, in some cases, were at liberty to impose protective duties, so as to exclude the manufactures of the mother country. That was a state of things that ought not to exist; but while it did exist to some extent, it was well to inquire how it had arisen, and whether there was any necessity for its continuance. The mother country had hitherto generously and gratuitously afforded naval and military protection to her colonies, but they did not in many cases require it; and it was contrary to common sense that they should be exempt from the taxation which was borne by the people at home for this object. He maintained that this state of things had in some cases arisen from the neglect of the mother country to make proper demands on her colonies in this respect, which would not have been resisted if made. It had been stated by Sir Henry Young that he sent home a despatch to the Secretary of State proposing that the colony over which he was placed should pay half the cost of the military protection, but to that despatch he never received any answer. In South Australia, whence he (Mr. Torrens) had recently come, they maintained a large volunteer corps; and in Victoria a vote of £20,000 had been passed for the supply of heavy artillery for that colony. He did not hesitate to say that the great majority of the colonies were prepared to take their fair share of these burdens upon themselves. With regard to protective duties against British manufactures, he thought that when constitutions were granted to them they ought to have been prohibited from imposing duties which had the effect of excluding the goods of the mother country from their markets. He believed the true remedy for this objectionable feature would be found—not in separation or federation—but in a closer union with the mother country. If, instead of treating the colonies as foreign states, we treated them as integral parts of the kingdom, the result would be different, and the productions of each country would be admitted to each without duty, to the mutual benefit of both; and under such a reciprocity the colonies might be fairly called upon to contribute to the support of the naval and military defence of the common country. If this were the case, however, the colonies might then lay claim to be represented in the British Parliament—not to the whole extent of their numbers, but in such a manner as that facts relating to the colonies might be laid before the House from a colonists' point of view. He believed that system to be a practical one, and that thus instead of the colonies being a source of weakness and exhaustion to the mother country, they would become her greatest strength and support.

Mr. J. Crawfurd said they had listened for an hour to Mr. Stones's paper, and he thought they all felt that hour was too short, so interesting had they found it. It had never been his lot to listen to a more comprehensive "state" paper; it might be regarded as the production of a true statesman, and he was most heartily obliged to Mr. Stones for it. There were, however, a few points in which he differed from him. He had said that most of our raw materials—even cotton—were derived from our colonies. His friend, Mr. Bazley, knew very well that cotton had not been brought to any great extent from our colonies. Our great supply of that article had been derived from a country which certainly ninety years ago was a colony of this empire, but which since that time had

become a cotton-producing country. We had been receiving some inferior qualities of cotton from India; but when peace was restored in America this product would come from that country as before, because no spot in the world appeared to equal the Southern States of America for the production of a high quality of cotton. He had no objection to make with regard to wool. Our colonies certainly did furnish us with enormous quantities of wool, and the prosperity of this country greatly depended upon that product. He thought, in the statement made by Mr. Stones, in which he attributed the rise of 20 per cent. in the wages of labour in this country to emigration, sufficient allowance had not been made for the large importations of gold from our own colonies. This enormous influx of gold had been going on for the last sixteen or seventeen years, and thus, in fact, our capital had been largely increased, giving employment to so many new hands, and constituting an additional demand for labour. Therefore, to the introduction of gold he principally attributed the rise of wages to which Mr. Stones had referred. With respect to confederation, he pretty nearly agreed with Mr. Stones on that subject. He did not see that any particular advantages would result from it to the colonies themselves, except, perhaps, in the case of the Canadas. He did not believe they would ever get Australia or New Zealand to form a confederation, inasmuch as danger from a foreign enemy was of the very remotest kind as regarded those colonies. They were able to defend themselves without soldiers, with the assistance of the British navy. The only great maritime powers who could attack them were France or America, and neither country had a navy equal to our own. With the Canadas, however, the case was different, with its 1,200 miles of frontier, which it was impossible to defend; with Montreal not more than 50 or 60 miles from that frontier, quite indefensible. He did not see what advantages New Brunswick or Newfoundland could derive from a confederation with the Canadas. He would say generally when any colony desired to part from us, the sooner we got rid of it the better. The Canadas were no great advantage to us; but we were bound in honour to defend them so long as they looked to us to do so. He did not, however, think we could defend them with success against the powerful nation that was on their frontier, who, with a large disciplined army, might at any time invade Canada; but, in his opinion, they would not do so because it could only be done at the cost of a vast sum of money; and the interest on their national debt already exceeded our own. Moreover, if they went to war with us, every port they possessed would be blockaded by our ships. He had, in conclusion, a very few words to say in reply to the observations of the chairman with respect to the ancient colonies. They were, after all, but very small matters. Every country that possessed a few boats—and the Greek vessels were little better—every country that possessed islands was pretty certain to engage in maritime enterprise, and the Greeks had an extraordinary enterprise for so small a people; for their whole number did not exceed the population of Australia and New Zealand at this moment. But for the discovery of America there would have been but little land for colonization, and previous to this discovery certain other discoveries were made: paper, printing, the polarity of the magnet, and gunpowder. Then it was that a great amount of maritime enterprise was manifested. In ancient times it was true that the Greeks planted themselves among barbarous nations, but there was little scope for colonization in the old world, while the new world afforded an almost unlimited field; and as soon as European enterprise was ripe for the work the foundation was laid of the vast colonies now owning British rule.

Mr. Thos. Bazley, M.P., fully concurred in the general impression as to the very able character of the paper; it contained much of enlightened policy; at the same time he thought that the author had in one or two places spoken hardly of the people of the United States, and of some of the leaders of the armies of the North. In this respect he begged to express the strongest dissent from him. Nor could he let pass, without a slight criticism, the remark which had fallen from his hon. friend in the chair, to the effect that the re-confederation of the States of America could not be looked for, and that it would be impossible to restore harmony between those States. He (Mr. Bazley) thought, seeing that victory had given to the North something like a restitution of territory, there was no occasion for that remark to have been made on this occasion, while we were uttering expressions of sympathy for the loss which the States had experienced through the murder of their President. The South had rebelled against the North; and the South had no moral claim to the sympathy of this great and free country, owing to the institution of slavery. The negro had been debased, but he was now receiving something like vindication in the punishment which was being inflicted upon the slave owners of the Southern Saates. We had given freedom to the slaves in the British West India Islands, and they were more productive under the state of freedom than they had been under the system of slavery. Touching the question of protection, there was the evidence of what we did for the West India Islands. When they were under the system of slavery we paid (owing to protective duties) an excess of price for sugar imported into this country exceeding the whole amount of manufactures we sent there. We then squandered £4,000,000 per annum in the form of protection to our West India Islands. As to the connection of this country with the colonies, he thought that so long as they could maintain that connection with us, by all means let them do so. They had our customs, language, and laws; he hoped also they had our common sympathies, and that they would feel it to be to their interest to remain in connection with us; but he was quite sure not a moment longer than they deemed it to their own interest would they hold to this connection, therefore we need not be under any great anxiety as to retaining them. As to the quantity of raw cotton supplied by the British possessions for the great trade of this country, he would only say, that in the year 1860, the last year in which the cotton manufacture of this country was working to the full extent of its power, 85 per cent. of the cotton used in this country was supplied by the States of America, 8 per cent. by Egypt, and 7 per cent. from British East and West India; and, he need not add, that the worst quality of all came from the East Indies. The high price of cotton in this country had had the effect of stimulating a supply from our dependencies; but the maximum quantity we had received from the East Indies during the cotton famine had been about one million of bags in the year. In 1860, the consumption of the cotton trade of the country was equal to $2\frac{1}{2}$ millions of bags; therefore, instead of a large per centage of the consumption coming from India under the most favourable circumstances, we had had only as 1 million to $2\frac{1}{2}$ millions. But about the time the American convulsion occurred, the quantity of cotton did not indicate the quantity which the machinery provided was capable of consuming; and he believed the augmentation of machinery in the large establishments would have led to a consumption of three millions of bags if it could have been supplied. Thus the maximum supply from the East Indies of inferior cotton had been equal to only one-third of the consumption; but the inferiority of that cotton was such that the moment we could obtain an increased amount of American, that moment would East Indian cotton cease to be used. Under these circumstances, there was no doubt that, unless the resources of the British colonies were developed so as to compete with the independent states of America and Egypt, we could not obtain large supplies of cotton from our possessions abro-
Nothing could be better than the woo-
without it he did not hesit-
the woollen trade could

or in Yorkshire. He wished to record the fact that Australia could supply cotton equal to any produced in the world. Whether it would be to the interest of Queensland, Victoria, or the other colonies of Australia, to supply it he was not prepared to say; but it was certainly one of the resources of our colonial empire yet to be developed. He thought our colonies must not continue to depend upon the naval and military establishments of the mother country for the continuance of the connection with them. It might be very agreeable to them to see the parade of military life mingling with every-day business in the colonies, but all this had hitherto been done at the cost of the people of England; and the time had arrived when the colonies must not only look to self-support, but also to self-defence.

Mr. Frederick Hill would only say a word or two on the important question of transportation. More than 200 years ago Bacon declared that it was a bad and an unholy thing to plant wicked men in distant climates, there to multiply in their depravity; and as far as his personal experience went, the information he had collected went to show this principle was correct. The colonies most interested in the question had in the most emphatic manner denounced transportation to their territories; therefore we must consider the question virtually settled, so far as existing colonies were concerned. He would call attention to the circumstance that, while on most branches of the subject Mr. Stones had presented them with an interesting array of facts, yet, on the subject of transportation he had only theorised. It had been incidentally stated that the substitution of lengthened terms of imprisonment for the punishment of transportation had been a failure. Everyone who knew what had been done in Ireland must admit it was a most eminent success. The result of most careful inquiry showed that the system in this country had only fallen into disrepute from the miserable manner in which it was administered. The system of lengthened imprisonment, which it was argued was impossible without producing madness, or other evils, had existed, and did exist still, in Germany and Switzerland without those evils arising. It was no part of a proper system of imprisonment to confine a fellow-creature within four narrow walls year after year. That was only the preliminary part of the punishment, but afterwards they were treated in a different way, and under good arrangements, there was no difficulty in making the criminals support themselves, and thus disposing of them without injury to ourselves or to any distant country. Mr. Stones had recommended the Falkland Islands as the *locale* for a future experiment in this direction. The locality most resembling that was Norfolk Island, and the depravity that existed there when it was an island full of convicts, and entirely without the element of free labour, was so fearful, that one shuddered at the contemplation of a repetition of such a state of things. He therefore sincerely hoped that no such experiment would be tried.

The Chairman said it was his pleasing duty to propose that the cordial thanks of the meeting be given to Mr. Stones, for what they must all regard as an unusually able paper. With reference to the remark that had fallen from Mr. Crawfurd, that our trade with the colonies ought to be of the character of a coasting trade, he might say that practically this was so. With only rare exceptions, there was nothing charged with duty coming from the colonies, which was not also liable to excise in this country. There was, in fact, the most perfect free trade. Whilst there was an import duty on coffee, which was a foreign produce, there was a duty also on chicory, which was of home growth. There was a duty on rum from the West Indies, but the same duty was charged on spirits manufactured in this country. The great [illegible]periority of the American cotton was to be attributed [illegible] —the fine alluvial tracts of the [illegible]pean enterprise, and African [illegible], produced the wonderful result of excellent cotton at 6d. to 8d. per lb. With regard to Australian cotton, he was afraid it was hopeless to think of it. He was satisfied that at the present price of labour there, cotton could not be produced under 5s. per lb. [Mr. Bazley assured the chairman he was mistaken. He had grown cotton in Australia, and knew differently.] With regard to transportation, he would say the Falkland Islands presented a much larger area than Norfolk Island, and under the system recommended by Mr. Stones they would be acting upon the old plan of convict colonisation. He did not despair of something being done in these islands.

The vote of thanks to Mr. Stones was then passed and acknowledged.

DUBLIN INTERNATIONAL EXHIBITION.

This Exhibition will be formally opened by His Royal Highness the Prince of Wales, on Tuesday next, the 9th inst., at two o'clock. The doors will be opened at eleven o'clock and closed at half-past one. The general arrangements throughout the building are rapidly progressing, and no fear need be entertained of the preparations for the opening not being complete in time.

WEST LONDON INDUSTRIAL EXHIBITION.

On Monday, the 1st inst., this exhibition was formally inaugurated in the Floral Hall, Covent Garden, by the Right Hon. W. F. Cowper, Chief Commissioner of Public Works, who took the chair at three p.m., being supported on the platform by the Archbishop of York; Mr. J. A. Nicholay, president of the committee; Sir J. V. Shelley, Bart, M.P.; Sir James Hamilton; Hon. F. Byng; Harvey Lewis, Esq., M.P.; Peter Graham, Esq.; Sir Thomas Henry; and others. Letters had been received from the Earl of Derby, Lord Stanley, and Mr. Gladstone, regretting that they could not attend.

The National Anthem and the 100th Psalm were then sung, and the Archbishop offered up a prayer appropriate to the occasion. The "Hallelujah Chorus" was then sung, after which Mr. Edmund Phelps delivered the ode written for the occasion by G. Linnæus Banks, Esq., entitled "Labour's Festival." Haydn's "The Heavens are telling" was then performed by the chorus; and

The Chairman delivered an address, in the course of which he said there was one point which made the present exhibition important. In it we were brought face to face with the man who did the work, and he earned his just meed of praise. There was in these days so much power in combined action, that there was some risk of the cause of individualism being overlooked. A skilful artisan, who had done good service to the firm employing him, often had reason to complain that his merits remained unknown, and, while his employers had the credit, the individual could not show what he was able to do. The hon. chairman went on to speak favourably of some of the objects in the exhibition. He then declared the exhibition open.

Sir John Shelley, M.P., proposed a vote of thanks to the chairman, which was seconded by Mr. Harvey Lewis, M.P., put by Mr. J. A. Nicholay, and carried by acclamation.

Sir James Hamilton moved a vote of thanks to the President and the Working Committee, which was seconded by the Hon. F. Byng, and passed unanimously.

Mr. Morrell briefly replied, and the Coronation Anthem—"Zadok, the Priest,"—was sung, and an inaugural march was played.

Space has been granted for 1,087 exhibitors, representing almost every branch of industry, from the profession of sculptor and artist to the humble calling of the costermonger, and by far the larger portion of the exhibition consists of amateur contributions.

Amongst the articles exhibited are many which were shown in the Exhibition of 1862, at the Society of Arts, at the coachmakers' exhibition this year, and at the recent district exhibitions; but the majority are articles manufactured strictly within the locality contemplated by the undertaking, and which are now for the first time brought under the eye of the public.

A certificate has been obtained from the Privy Council entitling exhibitors to the protection afforded by the Industrial Exhibitions Act, passed this session.

WORKING MEN'S FLOWER SHOWS.

Following out the laudable endeavours of the Royal Horticultural Society at South Kensington to promote the cultivation of flower-growing in what has been aptly styled "window gardens," a few of the inhabitants of Bayswater called a public meeting on Friday evening April 28th, to devise means for carrying out the Society's views among the working classes resident in the parishes of Paddington and Kensington. These parishes are, of course, divided into districts, and in some of these districts—far removed from human ken, so far as the stranger is concerned—resides a large number of the "sons of labour," consisting chiefly of men engaged in the mass of building operations going on all around the "royal" parish of Kensington. Opposite Palace-gardens, turning down a wretched-looking court, you find yourself *vis-a-vis* with squalid poverty in the notorious Jennings'-buildings—a "rookery" which is a foul blot upon the parish. Although at first one may be led to doubt if the inhabitants of these dismal hovels can ever be led to attempt window-gardening, if we think what has been done by the parish of Bloomsbury (in which is situated the notorious St. Giles's), we shall not find cause for despair. The question of its accomplishment is the thing to be considered. That it is fraught with difficulties we know, but when we consider the advantages accruing to the lower classes by inducing a love for flowers and a desire to cultivate them, the difficulties are in comparison trifling. A man who is fond of his garden is fond of his wife and children; a woman who tends her flowers with care is a woman of cleanly habits, and her room will be found tidy; she trains her children as she trains her flowers, with care and attention. Is it not, then, worth our while to make an effort to create and encourage window and house gardening among the poor. Socially and morally will they be benefited, and their improvement is not only their but our advantage. The audience at the meeting consisted principally of youths, members of the West London Youths' Institute, in the lecture-hall of which building the meeting was held. They were addressed by Mr. Bosanquet, who, in conjunction with the Rev. S. Hadden Parkes, has done so much to teach the working classes the science of home floriculture. Mr. Bosanquet gave a practical lesson in window gardening, and he was listened to with profound attention. He clearly showed the ease and the readiness with which geraniums, fuchsias, and annuals can be grown on window sills in any part of London. Mr. Broome, of the Temple-gardens, also gave some good practical hints, none of which were thrown away on his listeners. The advice given by one speaker (Mr. Sharp) is worth recording, as other gentlemen who may feel an interest in this movement may circulate it in their own parishes. He says, leave the matter to be worked out by the City missionaries and district visitors in each parish. They know the people; they have influence over them, and will be listened to. If this plan be followed out we believe the movement will be a successful one. Let but two or three families in a district show the first bright streaks of a newly-grown flower at their windows, and it will stimulate a desire among their neighbours to compete for the prizes to be given by the Royal Horticultural Society in July next, and thus lay the foundation for a Working Man's Annual Flower Show. M. S. M.

Fine Arts.

FLANDRIN EXHIBITION.—The collective exhibition of the pictures of the late Hippolyte Flandrin, in the new gallery of the Ecole des Beaux-Arts in Paris, has recently closed. It has attracted a very large number of visitors, and, on the whole, may be said to have proved a success. The fact of a large portion of the works being merely the sketches—in some cases, it is true, highly-finished drawings—instead of the works themselves, which are on the walls of the churches of Paris and other towns, dwarfed the collection as a whole, and the large works, such as the "Dante, conducted by Virgil, offering Consolation to the Shades of the Envious," "Euripides writing his Tragedies," "Saint Clair," "Jesus and the Children," were not of a sufficiently brilliant character to fill the void occasioned by the above circumstances. Of the sketches for the innumerable works executed by this artist, including those for the churches of Saint Séverin, Saint Vincent de Paul, and Saint Germain des Prés, in Paris, and Saint Paul, at Nimes, it is impossible to speak too highly with respect to drawing and industry; but, unfortunately, the composition is generally bald, even for mural painting, the attitudes wanting in originality, the colours flat, and the expression of the faces generally conventional, and wanting in enthusiasm. Passing, however, from the highest walks of the art to that in which Flandrin was, after all, most at home, the portraits deservedly draw forth a large amount of admiration. It is true that the charm of colour is almost entirely wanting. As Ary Scheffer performed strokes of genius in hues of dead leaves, so Flandrin has done miracles with black and plainness; he rarely succeeded in making a face pleasing, never in making one lovely, but the fidelity and life-like character of his portraits are marvellous. Amongst the pictures from the life, that of the present Emperor Napoleon III. is beyond question one of the most striking. The portrait of Prince Napoleon looked sombre beside its glaring companions—the likeness of Louis Napoleon and another of Napoleon I.—but its qualities are sound and real, and it is one of the works on which Flandrin's fame will rest. There is also a likeness of Baron James Rothschild, which is admirable in almost all respects. The gem of the collection, however, is the famous "Young Girl with the Pink," which created such a sensation in 1859, a likeness of Mademoiselle Maison, now La Baronne de Mackau. The face is an exquisite specimen of solid, vigorous, highly-finished work; the pose is perfectly natural, the dress is truth itself—there is nothing wanting but that indefinite charm which cannot be explained, but the absence of which leaves a vacuum that nothing can fill.

MONUMENT TO RAPHAEL.—The eldest son of Victor Emmanuel has performed a graceful act in accepting the honorary presidency of a committee formed for the purpose of erecting a monument in honour of this great artist in the city of his birth, Urbino, and the acceptance is announced in a note, in which General Revel says for Prince Humbert:—"To perpetuate the memory of men who, like the illustrious painter, have exhibited their genius in such brilliant colours, is a most praiseworthy act, and his Royal Highness could not fail to associate himself with such a generous and patriotic intention."

Manufactures.

ANILINE DYES.—The colouring matters produced from aniline and analogous matters are all, with the exception

of the Fuchsine and Perkins's violet, insoluble in water, and many attempts have been made to substitute a less costly solvent for the alcohol hitherto employed. M. Gaultier de Claubry, a French chemist, has recently taken out a patent for a method of accomplishing this. He says that a great number of substances, such as gum, mucilage, almond and other soap, glucose, dextrine, the gelatinous portion of various feculæ, of lichens, and of fuci, render water a solvent of such colouring matter, but that the best and most economical results are to be obtained by means of decoctions of the bark known as Panama (*Quillaïa saponaria*), or of the root of the Egyptian soap plant (*Gypsophila strutium*). The *Saponaria officinalis*, he adds, may be employed, but is less energetic in its action than the other two. The solutions are obtained by pouring the boiling liquors upon the colouring matter in powder, agitating, decanting, and, if the solution be not complete, repeating the process. The solutions thus obtained may be reduced to extracts by evaporation, but continued ebullition, especially if the water contain sulphate or carbonate of lime, may injure the colours. A better method, according to M. Gaultier de Claubry, is to triturate the powdered colouring matter with the extract of *Gypsophila strutium*, and then afterwards to add water by degrees, but, as the reds dissolve more readily than the blues, it is necessary afterwards to mix all the products together. The solutions obtained by means of the extracts above named are said to work readily with gum, dextrine, and albumen, separately or combined. The advantages claimed for the process by the patentee are economy, perfect unity of tints, which will not soil linen by contact, and suppression of inconvenience caused to the dyers by the use of alcohol or wood spirit. In connection with the latter it should be mentioned that the attempt to substitute it for alcohol has been defeated by the workmen, who have, in many instances, refused to use it on account of its effect on their health.

Vegetable Flannel.—A correspondent of the *Athenæum* writes:—Those of your readers who take an interest in the manufacture of vegetable flannel from the *Pinus silvestris* may like to have the additional information that since 1860 there are two establishments near Breslau, in one of which pine leaves are converted into wool, while in the other, for invalids, the waters used in the manufacture of pine wool are used as curative agents. The process for converting the pine needles into wool was discovered by Mr. Pannewitz. In the hospitals, penitentiaries, and barracks of Vienna and Breslau blankets made from that material are now exclusively used. One of their chief advantages is that no vermin will lodge in them. The material is also used as stuffing, closely resembles horse-hair, and is only one-third its cost. When spun and woven, the thread resembles that of hemp, and is made into jackets, spencers, drawers, and stockings, flannel and twill for shirts, coverlets, body and chest warmers, and knitting yarn. They keep the body warm without heating, and are very durable. The factories are lighted with gas made from the refuse of the above manufacture.

Commerce.

Lake Superior Copper.—The total copper product of Lake Superior in 1864, as per tables published in the *Mining Gazette and Miner*, is 8,561,999 tons, producing about 6,850 tons of ingot copper worth 6,850,000 dols., and from each district as follows:—Keweenaw District, 2,548 tons 808 lbs. shipped; Portage Lake District, 4,292 tons 1,691 lbs. produced; Ontonagon District, 1,722 tons 500 lbs. shipped; total, 8,561 tons 999 lbs. This amount would have been from 1,500 to 2,000 tons larger had it not been for a great falling off in the products of the Minnesota—the scarcity of labour in some of the districts, and its employment largely in opening new mines.

American Whale Fishery.—The year 1864 has witnessed a further decline in the number of vessels employed in this business, and the number now thus employed is less than at any time within the last 25 years, being 276, with an agregate of 79,692 tons. The greatest number within the above-named period employed in the whaling business was in 1846, which was 735, amounting to 233,189 tons. The present number of vessels, however, is as large as the business will warrant.

Colonies.

New South Wales Finance.—It appears that the actual deficit for the year 1863 and previous years amounted to £389,822 1s. 10d., and to meet this the Government issued Treasury bills to the amount of £400,000. The deficit for the year 1864 may be estimated at £400,000, and is accounted for as follows:—Decline in the customs, £60,000; decline in land revenue, £102,000; taxation scheme not passed, £220,000; total, £382,000. The statistics of the Mint for 1863 show that the operations for the year consisted in the reception and re-issue of 493,332 ounces of gold of the value of £1,908,526. Four-fifths of this gold was the produce of the colony, but some came from Victoria, some from New Zealand, and some from Queensland. The value of the coin issued was £1,534,750. The gold issued as bullion was only valued at £342,212. This shows that by far the greater portion of the gold sent to the Mint is re-demanded in the shape of coin, and that the demand for merely assayed bullion is small. This may be due partly to the fact that the charge for coinage and for assaying is the same, but perhaps mainly to the fact that the gold is shipped for India, and that it is more available there as coin than as bullion. The Mint revenue for the year was £23,602, of which £18,555 was due to the gold of the colony. The amount of coin and bullion in the colony at the close of the year was not more than £1,024,049, of which £962,426 was coin in the several banks. The amount of paper money in circulation at the end of the year was £824,347, or rather less than the value of the coin held.

The New Zealand postal contract with the Panama, New Zealand, and Australian Royal Mail Company has been ratified by the New Zealand government modifications. The subsidy, it appears, is to be £90,000, or, if a speed of 10 knots be adopted, £110,000.

Labour in Queensland.—The working classes have held a meeting on the subject of carrying out the eight hours system, which (as stated by the colonial journals) has been found to work satisfactorily in other colonies. There are few persons in the colony who do not approve of the movement, as, from the trying nature of the climate, it is physically impossible that any man can work for more than eight hours with credit to himself or with justice to his employer. The arrangement is one which rests almost entirely with the working classes to carry out, and, as they have before them the encouragement of success in other colonies, there is no doubt that they will obtain a public recognition of the desirability of enforcing the eight-hour system.

Gold in Queensland.—The northern diggers are sending down large quantities of gold from Peak Downs and other places. The reefs at Falgai are proving daily to be of increased value. It appears that the stone which is being found there is in many instances very rich, so much so that the holders of claims are asking very large sums of money for shares in them.

Tasmanian Revenue.—The total land revenue for the last quarter of 1864 was £21,810 1s. 4d., showing an increase of £9,820 6s. 9d. over the same period of 1863. The total customs for the quarter ended December, 1864, was £33,800 1s. 7d., and the total for the quarter ended

December 31, 1863, was £33,697 10s. 2d. The total revenue, inclusive of customs and inland for the quarter ended December 31, 1864, was £47,688 16s. 6d., and the total for the corresponding period of 1863 was £48,367 1s. 3d. The total, inclusive of special receipts for the quarter, was £81,142 13s. 10d., against £56,888 9s. 8d. for the corresponding period of 1863.

FISH CURING.—An establishment for fish curing has been set up by a couple of speculative Chinamen, on the shores of Battery Point, near Ross Shipbuilding-yard, for the drying and curing of fish for the use of their countrymen in Victoria. The establishment covers a small section of ground fronting the bay, and consists of a commodious store-shed and drying platform. The whole has been neatly fenced in, and a small hut erected for the accommodation of the enterprising proprietors. The establishment has been well stocked with huge casks and baskets for carrying out the process of curing and packing, and altogether about £50 or £60 has been laid out to put the place in good working order. The process observed is very simple. The fish are purchased from European fishermen. They are then cut open and thoroughly cleaned, after which they are placed on the drying platforms, where they are carefully dried. This is rather a delicate part of the operation, as the fish are liable to prove bad if not constantly watched, and the heat reflected by the sun's rays so regulated as not to stream upon them too strongly. To prevent this, a tarpaulin is attached to the platform, and spread or rolled up as occasion may require. During the process the fish are dried, salted, and, when sufficiently hardened, they are packed away in Chinese baskets, to undergo the process of packing. This consists simply in casking them up in brine when they are ready for shipment, and present a similar appearance to a good white herring. The fish which have been already cured consist chiefly of salmon, perch, mullet, flathead, and the mock-trumpeter, but it is expected that any of the numerous species which abound in the waters there will find favour among the Mongolian inhabitants of Victoria.

Obituary.

STULLER, the most celebrated architect in Prussia, died suddenly not long since at Berlin, at the age of 64. He was a native of that city, and a pupil of Skinkel, with with whom he remained till he had attained his thirtieth year. In 1835, in conjunction with M. Stack, he published a work entitled "Designs for Cabinet Work," which had the effect of resuscitating an art then almost lost in Germany; and he afterwards contributed to the "Album" of the Architectural Society of Berlin a long series of plans for palaces, museums, fountains, and other public works, which were eventually almost all carried into execution. Having obtained the patronage of the King of Prussia, he undertook and executed, between the years 1840 and 1850, an immense number of important constructions. Besides a vast number of private residences, he built the Council Chamber of Perleberg, the new Winter Palace of St. Petersburg, the Bourse of Berlin, and that of Frankfort, the New Berlin Museum, his greatest work; he constructed and executed part of the decorations of the Royal Chapel at Berlin; he built the churches of St. Mathieu, St. George, and erections in the Zoological Gardens of the same city; he added several new apartments to the palace at Potsdam, finished the gardens of Sans Souci, and erected the palace of the Grand Duke of Mecklenburg-Schwerin, in Berlin, and yet found time to make an immense number of designs for goldsmiths' work and porcelain.

Notes.

SUBURBAN MUSEUMS.—The Committee of Council have addressed a letter to upwards of two hundred gentlemen, including members of both Houses of Parliament, several clergymen, and many of the principal employers of labour in the north, east, and south of London, with reference to the establishment of Metropolitan District Museums of Science and Art, saying that "their lordships have had before them the several communications they have from time to time received on this subject, and are considering how the iron building of the South Kensington Museum may be made useful for the purpose." Those interested in the proposed establishment of these museums are invited to a meeting to be held in the lecture theatre of the South Kensington Museum, on Saturday, the 6th May, at 12 o'clock.

Correspondence.

MARINE ENGINES.—SIR,—On referring to Mr. Burgh's paper on Marine Engines, in the *Journal* a few weeks since, I see it stated that the origin of the "valve-link motion" is doubtful, a recent writer fixing its application to locomotives in 1832. As this date seems an error, and the link is universally used, I may perhaps recall that about ten years later (a fatal collision having taken place through the meeting of two trains at full speed), I was struck with the imperfection of the "fork" and "hand gear" system of reversing then in use, and described by Tredgold, Wood, &c., and sent a drawing of what is now known as the "slotted-link" to Mr. Edward Bury, locomotive superintendent of the London and Birmingham Railway, at Wolverton. He much approved the design, but preferred the hand gear for his small four-wheeled engines on that line; and I wrote to some other engineers, and afterwards made a working model of the link at the College for Civil Engineers, Putney, with the approbation of the Professor of Machinery, and showed it at the annual meeting. It soon after appeared on the railways. Being a youthful student I could not follow up the idea further, and I have hitherto refrained from claiming originality for my design, which all who saw it then admitted to be novel.—I am, &c., GEO. P. RENSHAW.

Nottingham, May 2, 1865.

MEETINGS FOR THE ENSUING WEEK.

MON. ...R. Geographical, 8½. 1. Capt. Toynbee, R.N., "Physical Geography of the Seas between England and India." 2. Dr. Kirk, "Rovuma River, East Africa." 3. Dr. Gunst, "Recent Travels in Unexplored Parts of Madagascar."
Royal Inst., 2. General Monthly Meeting.
Society of Engineers, 7. "Discussion on Mr. King's Paper on Irrigation with Town Sewage."

TUES. ...Society of Arts, 8. Cantor Lectures. Dr. F. Crace Calvert, "On some of the Most Important Chemical Discoveries made within the last two years." (Lecture V.)
Medical and Chirurgical, 8½.
Civil Engineers, 8. Renewed Discussion "On Uniform Stress in Girder Work." And, Mr. E. Fletcher, "On the Maintenance of Railway Rolling Stock."
Zoological, 8½.
Syro-Egyptian, 7½. Mr. Sharpe, "On the date of the Book of Revelations."
Photographic, 8.
Ethnological, 8. Rev. F. W. Farrar, "On Language in Relation to Ethnology." 2. Sir Woodbine Parish, "On the Indians of South America."
Royal Inst., 4. Prof. Frankland, "On Organic Chemistry."

WED. ...Society of Arts, 8. Captain Selwyn, "On the Art of Laying Submarine Cables from Ships."
Geological, 8.
Graphic, 8.
Microscopical, 8.
Literary Fund, 3.
Archæological Assoc., 4½. Annual Meeting.

THURS...Royal, 8½.
Antiquaries, 8.
R. Society Club, 6
Royal Inst., 4. Prof. Frankland, "On Organic Chemistry."

FRI.......Astronomical, 8.
Royal Inst., 8. Mr. Frederick Field, F.R.S., "On Magenta and other Dyes."
SAT.......R. Botanic, 3¾.
Royal Inst., 4. Prof. Bain, "On the Physical Accompaniments of Mind."

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 29th March, 1865.*

54. Bill—Municipal Corporation (Ireland) Act Amendment.
152. Malta and Alexandria Telegraph—Accounts.
154. Crown Debts and Obligations—Return.

SESSION 1864.

507 (A IX). Poor Rates and Pauperism—Return (A.)
577. Taxes in Europe—Return.

Delivered on 4th April, 1865.

68. Bills—Judgments (Ireland).
92. ,, Trusts Administration (Scotland).
98. ,, Trespass (Scotland).
3 (292 to 297). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 292 to 297.
155. Railway, &c., Bills—Return.
176. Deaths of Seamen—Return.
177. Spirits—Returns.

Delivered on 5th April, 1865.

97. Bills—Educational and Charitable Institutions.
99. ,, Public Offices (Site and Approaches) (as amended by the Select Committee).
100. ,, India Offices (Site and Approaches) (as amended by the Select Committee).
102. ,, Commissioners of Supply Meetings (Scotland).
3 (298 and 299). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 298 and 299.
90 (V). Civil Service Estimates (Class V.)
147. Doe Park and Bradford Reservoirs—Further Correspondence.
160. County Courts, &c.—Return.
Manufactures, Commerce, &c.—Reports (No. 8.)

Delivered on 6th April, 1865.

103. Bill—Bankruptcy and Insolvency (Ireland) Act Amendment—Lords Amendments.
62. East India (Oude)—Papers.
92 (VII). Civil Service Estimates (Class VII.)
178. Open Spaces (Metropolis)—First Report of Select Committee.
184. War Office—Reports relating to the Organization.

Delivered on 7th April, 1865.

104. Bill—Commissioners of Supply (Scotland).
56 (I). Weights and Measures (Metropolis)—Returns.
168. Night Refuges (Metropolis)—Return.
171. Metropolis Sewage and Essex Reclamation Bill—Special Report and Evidence from the Select Committee.

Patents.

From Commissioners of Patents Journal, April 28th.

GRANTS OF PROVISIONAL PROTECTION.

Bedsteads—149—E. Deane.
Boilers—974—J. Brown.
Bolts, machinery for manufacture of railway—992—T. Wilkes.
Brushes, rotating—920—J. Drinkwater.
Burglary, signals and alarms in the event of—975—J. S. Watson and A. Horwood.
Cables, construction of submarine telegraph—1031—W. E. Newton.
Carriages, couplings for railway—1035—J. Dadley.
Chains, forming the links of—1004—A. Homfray.
Corks, apparatus for shaping—1065—J. McDowall.
Cotton, machinery for preparing—998—M. S. Maynard.
Cooking utensils—1041—F. P. Warren.
Cuffs, ornamenting linen—1010—J. Debnam.
Cylinders, cushions for steam—1079—F. C. Bakewell.
Door locks—1043—J. Walker.
Dyeing, colouring matters for—705—F. Wise.
Engines, apparatus to actuate the valves of—982—J. G. Jones.
Engines, electro-magnetic—1012—S. Moore.
Fabrics, machinery for folding—1057—W. S. Yates.
Files, heating—1020—W. Brooks.
Flour, dressing of—898—W. Savory.
Frames, clamps for stretching—1039—H. Bridson.
Furnaces—240—C. De Bergue.
Fuze—1049—J. S. Bickford.
Gases, method of mixing—997—W. Jackson.
Glass, preventing corrosion of the surface of—984—W. B. Richards.
Gloves, boxing, &c.—382—H. Emanuel.
Harrows, &c.—978—J. Badger.
Injector, Giffard—1051—A. V. Newton.
Inkstands—1089—J. Merritt.
Invalids, support for—1069—T. E. Harding.
Iron—1023—C. Vaughan.
Lace, machinery for the manufacture of—1087—R. A. Brooman.
Land, machine for tilling—671—E. A. Phillips.
Machine, destroying the momentum of heavy bodies by an elastic—321—C. R. Markham.
Machine, hand drilling—1015—J. White.
Meat, machine for cutting—1077—A. W. Hale.
Metals, planing and shaping—856—J. Todd.
Nail—994—J. Brown.
Napkins, apparatus for weaving borders on—3190—W. D. Gedge.
Oils, increasing the illuminating power of hydro-carbon—980—G. Davies.
Paddle-wheels—935—W. C. Gollings.
Petroleum, apparatus for storing—1027—R. A. Brooman.
Pistons, metallic—1059—S. Dawson, J. Burgess, and J. Wilson.
Ploughshares, &c.—996—W., E., and J. Gray.
Property, safes for securing—1000—T. Skidmore.
Railway trains, signalling on—1055—A. Westhead.
Rifle shooting, supporting and steadying the arm in—1014—J. B Hausman.
Rivers, apparatus for deepening—1017—C. F. Gheerbrant.
Rocks, apparatus for boring—981—J. H. Johnson.
Rods, tapered—1018—R. A. Brooman.
Safes, fire-proof—439—A. Clark.
Safes, locking arrangements for—1045—J. M. Hart.
Scrolls, apparatus for cutting—926—J. Kennan.
Ships, lighting and ventilating—995—H. Edmonds.
Ships, compositions for preventing the fouling of—1008—G. Davies.
Smoke, apparatus for purifying—1001—M. Henry.
Spinning, apparatus for preparing cotton for—990—J. Thompson.
Steam generators—1029—J. H. Johnson.
Stones, machinery for cutting—1093—M. Vogl.
Swings, rotatory aerial—1073—J. J. Matthewson and H. L. R. Schlee.
Tables, portable frames and joints for—542—C. Whiting.
Tin, manufacture of—1081—J. J. Jenkins.
Trucks, apparatus for covering railway—1075—E. and G. H. Morgan.
Watches—1033—L. B. Phillips.
Weaving, looms for—1061—C. Turner and T. Room.
Weights, pulleys for lifting—1091—F. W. Gilbert.
Wheels, steel tires for railway—878—F. W. Webb.
Umbrellas, rib holders for—918—T. K. Mace.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Capes, &c.—1128—J. Emary.
Maps, dissected—1137—H. A. Bonneville.

PATENTS SEALED.

2700. P. A. Roger.	2731. F. S. Gilbert.
2704. W. Smith.	2732. F. L. Bauwens.
2705. R. Richardson.	2737. R. K. and K. T. Bowley.
2711. J. Drury.	2744. M. J. Roberts.
2719. C. Garton and T. Hill.	2778. J. D. and A. P. Welch.
2720. E. T. Hughes.	2779. G. B. Galloway.
2722. E. G. Brewer.	3073. J. Ramsbottom.
2723. H. W. Spencer and J. E. Ball.	89. J. Ramsbottom.
	375. J. Ramsbottom.
2726. W. Bayliss.	643. J. Dean.

From Commissioners of Patents Journal, May 2nd.

PATENTS SEALED.

2733. F. Yates.	2801. W. L. Lees.
2734. F. Yates.	2812. C. Mohr and S. E. Smith.
2740. J. Sullivan.	2829. P. A. le Comte de Fontaine-Moreau.
2741. J. Snider, jun.	2856. S. C. Kreeft.
2748. A. Estourneaux and L. Beauchamps.	2901. W. E. Newton.
2751. W. Thrift.	2921. P. Garnett.
2766. R. Rimmer.	2922. J. Paley & T. Rawsthorne.
2769. L. C. Meaulle.	2960. M. A. F. Mennons.
2772. A. Bechem & H. Wedekind.	3160. H. Bird.
2785. J. Dale, H. Caro, and C. A. Martius.	3205. A. V. Newton.
2797. H. Brockett.	210. T. Steel.
	481. R. Willison.
	630. G. Nimmo.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1214. J. Elder.	1293. W. Bodden & W. Mercer.
1221. W. Fisken.	1301. M. Paul.
1247. J. W. and F. G. Caley.	1253. J. Ross.
1252. W. Clark.	1279. W. Staufen.
1245. G. R. Samson.	1281. J. M. Napier.
1268. G. Davies.	1318. J. Fowler.
1265. A and B. Travis.	1355. J. E. Ransome, W. Copping, and L. Lansdell.
1275. J. Oxley.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

938. D. E. Hughes.	969. W. Clark.

Registered Designs.

Life Belt—April 21—4708—Captain John Ross Ward, R.N., 14 John-street, Adelphi, W.C.
Lever and Spring for Spinning Frame Rollers—April 21—4708—W. Oxley and Co., Manchester.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, MAY 12, 1865. [No. 651. VOL. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

MAY 17.—"On the Manufacture of Encaustic Tiles and Ceramic Ornamentation by Machinery." By ZERAH COLBURN, Esq.

MAY 24.—"On the Development of the Trade with India, and the Bombay International Exhibition of 1866." By J. FORBES WATSON, Esq., M.D.

CANTOR LECTURES.

The Third Course for the present Session, consisting of six Lectures, "On Some of the Most important Chemical Discoveries made within the last Two Years," by Dr. F. CRACE CALVERT, F.R.S., F.C.S. (Corresponding Member of the Royal Academy of Turin; of the Société Industrielle de Mulhouse; of the Société Imperiale de Pharmacie de Paris, &c.), will be concluded on Tuesday evening next, at Eight o'clock, as follows:—

MAY 16TH.—LECTURE 6.—On the Discoveries in the Chemistry of Metals and Alloys.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture.

Proceedings of the Society.

DWELLINGS FOR THE LABOURING CLASSES.

The Committee appointed by the Council to consider this subject* have made the following report:—

The consideration of the best means of improving the dwellings of the labouring classes has for some time engaged the attention of the Society of Arts. In February, 1860, Mr. Twining undertook to collect information, both financial and sanitary, with regard to the efforts then being made for providing improved dwellings in town and country. The result of his inquiry was a large and important collection of statistics, which are now deposited in his museum at Twickenham. In order to reduce the information thus collected into a shape which might be useful in future efforts of a similar nature, a special committee was appointed by the Council on the 4th of November, 1863. The report of this committee, which has been printed and circulated, was prepared by Mr. Rigby, with the assistance of Mr. Twining. It contains a concise account of the various blocks of dwellings and renovated houses for families and single men in the metropolis and suburban districts, under the management of societies established for improving the dwellings of the labouring classes, or of individuals interested in the same subject, together with a statement of the primary outlays, annual receipts and expenditure, and other particulars, of these various buildings, arranged in a convenient tabular form.

With a view of eliciting further information on this important subject, the Council invited the attendance of all those who were interested in the movement to a conference on the 26th May, 1864, and on the following day. A large number of those who had taken a leading part in providing better dwellings for the labouring classes, both in London and the country, attended the conference, and much interesting discussion took place. It was strongly urged upon the Council by this meeting to form a committee, for the purpose of taking the whole subject into consideration, and in particular for considering in what way the Legislature could promote the erection of proper and sufficient dwellings for those classes who are so much in need of them.

The Council accordingly, shortly before Christmas, 1864, issued an invitation to various persons, whose interest and experience in the subject were likely to render their advice valuable. The committee met for the first time on the 22nd December, 1864, and continued their sittings during the spring of this year.

At the first meeting of the committee it was unanimously resolved that it was not necessary to collect facts to establish the unfitness of the greater part of the dwellings of the labouring classes as habitations for respectable and well-conducted families, or to prove that the excessive overcrowding which now exists in such dwellings promotes crime and immorality, harbours disease, and materially lessens the effective power of the working-classes, by injuring their health and shortening the duration of their lives.

* See present Vol. of the *Journal*, p. 145.

Nor was it considered necessary to inquire into the effect produced by these badly-constructed, ill-ventilated dwellings on the poor-rates, or into the amount of discontent which the admitted want of proper dwellings creates in the minds of the working-classes. The committee also recognised the distinction which must be drawn between associations for providing improved dwellings by investments for the labouring classes, the capital for which is subscribed with the double object of obtaining a fair interest on the money advanced, and of elevating the social and moral condition of the working classes, and the regular investment in such buildings by builders who must obtain the ordinary commercial profit on capital used in business. In the first case, a dividend of 5 per cent., with an ample fund to provide for all contingencies might be considered sufficient, whilst in the other case a very much larger return would be required. Considering these facts as fully established, the Committee proceeded to inquire into—

(1.) The causes which appear to retard the erection of proper house accommodation, and the improvement of existing houses, for the working classes in town and country.

(2.) The operation of imperial and local taxation on such dwellings; and the expediency of relieving them from all or a portion of such taxation.

(3.) The effect of the law of settlement and removal of the poor upon such buildings in country districts.

(4.) The probable effect of extending the area of local taxation in town and country.

(5.) The operation of the laws relating to the transfer of real property in small plots, and the conveyance of chambers and *suites* of rooms.

(6.) The operation of the destruction of houses by railways and other local improvements.

(7.) The desirability of facilitating the conveyance of labourers to and from their work by railway.

(8.) Whether the provisions contained in the existing Acts of Parliament, for granting loans for the improvement of estates, might not be extended to the building of cottages, and if so under what special conditions.

(9.) Whether the provisions of the common lodging-house act, and other statutes relating to the public health might not be advantageously extended.

(10.) Whether there are any other means by which the legislature can promote the object in view.

It was at first proposed to divide the subjects betwene three sub-committees, according to their relation to town dwellings, country dwellings, and proposed legislation, but it was found in practice better to amalgamate the sub-committees, as the subjects referred to each sub-committee were so similar. The following gentlemen attended the meetings: Mr. W. Hawes (Chairman), The Hon. and Rev. S. Best, Mr. D. R. Blaine, Mr. C. B. P. Bosanquet, Mr. C. S. Barker, Mr. Edwin Chadwick, C.B., Mr. G. R. Burnell, Mr. H. Cole, C.B., The Right Hon. W. Cowper, M.P., Mr. J. B. Denton, Mr. J. Dillon, Mr. H. B. Farnall, Mr. P. Le Neve Foster (Secretary of the Society of Arts), Professor Fawcett, Mr. C. Gatliff, Mr. G. Godwin, F.R.S., Dr. Greenhill, Mr. T. Hare, Mr. H. Harwood, Mr. E. T. Holland, Mr. C. Wren Hoskyns, Mr. H. Maynard, Mr. H. Pownall, Mr. S. Redgrave, Mr. B. Shaw, Dr. E. Smith, F.R.S., Mr. S. Teulon, Mr. T. Twining, Mr. G. H. Walker, Mr. Alderman Waterlow, Mr. G. F. Wilson, F.R.S., Mr. T. Winkworth, Mr. J. Young; and Mr. M. Ware, who acted as Secretary to the Committee.

Various resolutions were passed with respect to the questions considered by the committee, the recommendations of which are embodied in this report.

Improved Dwellings for Labourers not Remunerative.

It was shown that labourers living in the metropolis and other large towns pay a larger proportion of their income for rent than any other class in the country, and even then are unable to obtain suitable accommodation. The immediate cause of this state of things, in places where the law of parish settlement does not cause an additional difficulty, is the fact that providing such dwellings for labourers has not been found commercially remunerative. The efforts of societies and benevolent individuals are every year becoming more extensive, and from the beginning have been appreciated by the industrious classes. They have already accomplished a great amount of good, and have set an example which, it is hoped, will be more extensively followed; but it will be long before the existing evils can be more than slightly mitigated by such means. At present the dwellings provided in this manner in the metropolis only accommodate about 7,000 persons, and the commercial results are not such as to encourage builders and capitalists to undertake the building or renovation of dwellings for labourers as an ordinary matter of business. It appears, from the statistics collected by the Society of Arts, that it rarely happens that such undertakings produce a higher dividend than 5 per cent. on the original outlay, and that in most cases the returns are smaller. This rate of interest may be expected to satisfy a large number of capitalists, who are willing to accept a moderate return upon capital when connected with such important philanthropic objects, but it can hardly be expected that dwellings will be provided in anything like sufficient numbers until they can be made to produce such a return as will compensate a builder for investing his capital in this kind of property, attended as it is with so much more risk and trouble than houses of a superior class.

The difficulty of remedying this state of things is aggravated by the fact that the wretched houses which too many of the labouring classes now inhabit are, in their present condition, highly remunerative to the landlords. Consequently such houses fetch a high price when brought into the market. They may be made to yield a good profit in the hands of those who care nothing for the moral and physical well-being of their tenants; but the expense of putting them into proper sanitary condition, and adapting them to the wants of respectable working-men, reduces the returns so much as to render the undertaking, in a commercial sense, unprofitable.

It may be here remarked that the reproach which has been sometimes brought against societies established for providing improved dwellings, that they consider only the wants of the higher class of labourers, is not now deserved. Several societies have now under their management both blocks of buildings and renovated cottages, in which the poorest labourers are accommodated in single rooms at weekly rents of 1s. 3d. to 2s. 6d. The effect of this is to bring the societies into closer competition with the class of landlords before spoken of.

Some of the causes which tend to render such property unremunerative are beyond the control of any interference, as, for instance, the increasing value of land and buildings in the great centres of industry and the excessive wear and tear of buildings inhabited by poor tenants. The other causes may be classed under two heads—1. Those which may be removed or modified by the legislature. 2. Those which must be remedied, if at all, by increased care and experience in the purchasing of sites, and in the erection of buildings, and in the placing them under economical and efficient management.

The Committee at the outset of their deliberations determined to direct their attention principally to the first of these two classes, with the hope that they might be able to suggest such amendments of the law as would secure to capitalists investing money in this kind of property a fair return on their capital.

Among the burdens which press upon the owners of houses or blocks of dwellings for the labouring poor are the following:—

Rates and Taxes.

It has been commonly put forward, and is very gene-

rally supposed, that the amount of taxation, local and otherwise, to which property of this kind is subject, is so large as materially to affect the returns which a capitalist or builder would calcutate upon as remunerative when contemplating the erection of dwellings for the labouring classes.

It appears to your committee, after investigating the accounts connected with a considerable number of such dwellings, that the total amount of taxation from all sources does not exceed 1½ per cent. on the whole capital invested, an amount which (even if the exemption from the whole of such taxation were practicable) is too small to exercise any appreciable influence on those contemplating the investment of capital in an undertaking of this nature. Under these circumstances, and considering the violation of sound principles involved in making any exemption in favour of any particular class of house property, the Committee do not feel justified in proposing the adoption of any measure of exemption.

The house duty may be usually avoided in blocks of buildings whose size would otherwise make them liable to it, by giving to each set of apartments a door opening to the external air, and making them thereby a distinct tenement. This is called the external gallery system.

Parish Rating in the Country.

The question of charging the relief of the poor on the parish or on the union, is one which peculiarly affects the building of cottages in the country. The present system has long been found one of the greatest obstacles to the proper accommodation of labourers on the estates on which they work; and the committee were prepared to recommend an amendment of the law by the extension of the chargeability of the poor from the parish to the union. It is a gratification to the committee that the same views on this important question have been generally recognised by the legislature, and that they are likely to be carried into operation by the Bill now before Parliament. The committee confidently expect that many good results will follow from the adoption of that measure.

Parish Rating in the Metropolis.

It was a subject of consideration by the Committee, whether similar good results would not be produced by extending the area of chargeability in the metropolitan districts. In the discussion of this question the committee were much aided by statistical tables furnished by Mr. Farnall, and by his large experience in this subject. It appeared from these tables, in which the amount of the poor-rates were reckoned according to their proportion to the gross rental, instead of on the present capricious system of assessment, that the pressure of the rates on property in the metropolitan parishes is not so unequal as is generally supposed; and in the opinion of the committee the inequality which really exists does not in any perceptible degree form an obstacle to the erection of dwellings for the labouring poor. Whatever other causes, therefore, may exist to render it desirable to extend the area of chargeability in the metropolis, the committee do not think that such extension will produce any sensible effect in furthering the object specially under their consideration.

State of the Law of Real Property.

Some very interesting discussions took place on the difficulties the present state of the law of real property interposes in the way of those who are desirous of providing dwellings for the labouring poor, and of labourers who wish to become the owners of the dwellings in which they reside.

Much of the land in London and other large towns belongs to Charities and other Corporations and persons under disability, or is in strict settlement. Much has been done by modern legislation towards enabling trustees of settled estates and limited owners to grant building leases, and to sell portions of the estate for the benefit of the rest, under the direction of the Court of Chancery. But, independently of the expense of an application to the Court, there are many cases which are not met by these enactments.

The Committee suggest that corporations, limited owners, and persons under disability should have similar powers of selling small pieces of land for improved dwellings for labourers as they have now for selling sites for schools—(under the 4 and 5 Vict., c. 38, &c.), and for literary and scientific institutions, under the 17 and 18 Vict., c. 112).

The Committee had the advantage of the presence of Mr. Hare to explain his scheme for encouraging the investment by labourers of their savings in the purchase of sets of rooms in large blocks of dwellings. He proposes that each block of dwellings should be registered under the Land Registration Act, and should obtain a certificate of indefeasible title; that when that is done, the building should be withdrawn from the ordinary laws and incidents of real property, and should become personal estate; and that the apartments in it should be transferred as separate tenements, in the same manner as stock is transferred in the public funds. In this way he hopes that the tenants would become absolute owners of the rooms in which they live, paying off the purchase money in a limited period by instalments, very little greater in amount than their rent as weekly tenants. He also proposes that the management of the entire building should be vested in a committee chosen from the owners of rooms, who would regulate their mutual rights and liabilities, and enforce the good preservation and repair of the rooms and the orderly conduct of the inhabitants.

The Committee agreed in the expediency of any mode of facilitating and cheapening the conveyance of small tenements, but they considered that the difficulties and embarrassments, both to seller and buyer, which would arise out of any plan by which the apartments in a large block of buildings would become vested in individuals of the labouring class, would outweigh any benefit which might arise from it. The danger of such small tenements falling into the hands of speculators, who might take advantage of the necessities of the original owners; the obligation under which the working classes live of continually and suddenly changing their residence in search of work, the probability that the rooms would not be so well kept as when owned by a company; and the difficulty of arranging the mutual interests of so many small independent freeholders, seem to the Committee insuperable objections to the scheme.

At the same time there appears to be nothing in the present state of the law to prevent a company owning such a block of dwellings, after they have obtained an indefeasible title, from letting the sets of rooms as separate tenements on leases of any duration, subject to proper sanitary arrangements; and the Committee believe that such a plan might, in many cases, be desirable. In such a case, the tenant would secure the benefit of a lower rent than if he were a weekly tenant, and would acquire the feeling of property in his own home; while, at the same time, the company would be secured by covenants and powers of entry against dilapidations and misuse of the tenement.

Loans by Government.

Numerous Acts have been passed, commencing with the 57 Geo. III., c. 34, for enabling the Public Loan Commissioners to advance money at a low rate of interest for public works and the employment of the poor, the money borrowed being repaid by instalments in a limited period. The 9 and 10 Vict., c. 79, is the Act which regulates the present practice. By the 23 and 24 Vict., c. 19, the Public Works Acts (Ireland) were extended to authorise the advance of money for building cottages for labourers in that country. In England the Public Loan Commissioners have never been authorised to advance money for that purpose; but by

the 9 and 10 Vict., c. 74, they are enabled to lend money to vestries on the security of the rates for building public baths and washhouses. By the 14 and 15 Vict., c. 34, the same Commissioners are also empowered to lend to boards of health, and other local authorities, in like manner, money for building lodging-houses for the poor; this Act, however, is encumbered with so many conditions that it has been practically inoperative.

There is also another series of Acts (9 and 10 Vict., c. 101, &c.), enabling the Inclosure Commissioners to advance money in the same way to landowners for drainage and improvement of land; and under the Private Advance for Drainage Acts (27 and 28 Vict., c. 114, &c.), tenants for life, and other limited owners, can borrow money from private sources for the same purposes. The Inclosure Commissioners appear to have no power to advance money for building cottages, but this may be done by the Drainage and Land Improvement Companies.

So far, therefore, as relates to cottages in the country, the committee do not desire any alteration in the law, but they recommend, with respect to labourers' dwellings in towns, that the public Loan Commissioners should have power to advance money at a rate of interest not exceeding 3½ per cent., for building such dwellings, with due regard to sanitary arrangements. The committee believe that by such assistance the promoters might be enabled to add materially to their profits, and that the building of such dwellings would thereby be much encouraged.

Demolition by Railways, &c.

The effect of the demolition of the homes of the poor by local improvements and by metropolitan railways has been lately very much before ythe public. In the Earl of Shaftesbury's speech on the 31st March, in moving for an amendment of the standing order of the House of Lords upon this subject, his lordship stated that the houses for the demolition of which notice had been given under the bills before Parliament in the present session, amounted to 3,500, containing a population of 20,000 persons.

Although a large number of these houses will not be actually destroyed, being merely included within the limits of deviation, yet the numbers give some, though an imperfect, idea of the vast amount of inconvenience and distress such works must produce among the poor. It has been proved, by careful inquiries on similar occasions in former years, that a very large proportion of those who are displaced do not leave the immediate neighbourhood, but crowd still more the already over-crowded dwellings of the same parish. And, in most cases, the Committee believe that this is not merely a temporary evil, because the necessity of being near their work forms an obstacle to their dispersing into more distant places.

It is the opinion of the Committee that where public companies destroy houses inhabited by the working classes under compulsory powers, they ought to be compelled to provide sufficient improved dwellings within a convenient distance for the same classes in place of those destroyed, and that they should have special powers given them for that purpose.

An evil is likewise sometimes perpetrated by railway companies, though probably to a comparatively small extent, by taking the yards or back premises of houses and reselling them for occupation by labourers, with reduced sanitary accommodation. The Committee are of opinion that in such a case the company should not be allowed to sell such houses without making provision for their proper ventilation and for the sanitary accommodation of their inmates.

Workmen's Trains.

Another plan for relieving London of some part of its overcrowded population is to encourage labourers and their families to live a few miles out of London, and to transport them to and from their work in the morning and evening by cheap trains. The number of small houses now building in the suburbs of London is very great, and as working men discover by experience the advantages arising from improved health to themselves and to their families from living away from the crowded streets where they now lodge, the demand for them must increase; but even this improvement will be but temporary, and will shortly produce a new set of evils, unless the erection of these houses be carefully watched and their drainage, ventilation, &c., be properly attended to. Precautions against overcrowding will also be as much required as in existing houses. The Metropolitan Railway Company have been trying the experiment of running workmen's trains for some months with marked success. They provide early trains from Paddington and from the City, which are used almost exclusively by working men, and they allow them to return by any train in the afternoon. No inconvenient restrictions respecting tickets are imposed, and the weekly increase of numbers is very satisfactory, and when the system is extended to Hammersmith still better returns may be anticipated. The London, Chatham, and Dover Railway Company have done the same, in pursuance of a clause in their Act, since the beginning of March. From a statement by Mr. Forbes, the general manager, in a letter quoted by Lord Shaftesbury, in his speech before referred to, it appears that the number of workmen carried by their trains has increased week by week; but the unnecessary restrictions imposed by this company upon the men using these trains must be removed before the low rates will be profitable to the company, or available, to any important extent, to workmen.

The Committee desire to express their decided opinion that it would be for the benefit of the community at large that all the metropolitan railway companies should provide cheap means of transit, at convenient times, for labourers; but they hesitate to recommend that this should be made compulsory in all cases, believing that if their views of the results likely to arise from such accommodation to the working classes be correct, the directors of the railway companies will not fail to adopt them.

There is also another view of the subject which must be noticed by the Committee, namely, the tendency of manufacturers to remove their works from the crowded centres of large towns to suburban districts. Such a practice is likely to produce very beneficial results. While healthier dwellings are provided for those who work in the manufactories, the overcrowded condition of those who are obliged to remain in the heart of the cities will be proportionally relieved.

Enforcing the Sanitary Laws.

Whatever progress may be made in building or adapting houses by individuals or societies, the great mass of the labouring population for many years to come must necessarily live in very crowded neighbourhoods, in houses now existing, and not originally adapted to contain several families under one roof.

It is, therefore, of the first importance that the owners of existing houses, inhabited by the poor, should be obliged to provide those sanitary appliances which are required for the preservation of the health of their tenants, and to check, when it occurs, the progress of infectious disease. Long experience has shown that nothing but constant inspection and compulsory measures will meet the carelessness and cupidity of the owners of this kind of property.

The present sanitary laws are comprehensive, and on the whole efficient, although there are some particulars in which the Committee think they require amendment, especially with relation to the inspection of houses let to lodgers, but not now subject to the provisions of the Common Lodging House Act. The provisions of the sanitary acts are not, however, sufficiently known, nor do those who are qualified by intelligence and position to attend to the

sanitary condition of their own neighbourhood interest themselves as much as could be desired in seeing that the powers of the law are put in execution.

The Committee recommend that a consise analysis of the sanitary laws should be prepared, and that the defects of the existing law should be printed and circulated. In this way the attention of men of education and intelligence would be called to the subject, and they might be induced to take part in sanitary work in the neighbourhood in which they reside or carry on business.

In the country districts the sanitary condition of the people is regulated by the Nuisance Removal Acts, 18 and 19 Vict., c. 121 and 23, and 24 Vict., c. 77, and the Local Government Act, 21 and 25 Vict., c. 98; the power being vested in the Local Board of Health, or, if there be none, in the corporations of towns, boards of guardians, or parish vestries, according to the circumstances of each locality.

In the City of London the power is vested in the Commissioners of Sewers, under the Acts regulating the administration of the City.

In the other Metropolitan districts the vestry or district boards are the local authorities for the removal of nuisances, under the Metropolis Management Acts, 18 and 19 Vict., c. 120, and various Amendment Acts.

By the 21 and 22 Vict., c. 97, the powers of the General Board of Health were transferred to the Privy Council, which has a general superintendence of sanitary matters. This branch of their duties is practically exercised by the medical officer of the Privy Council. The committee think that there should be a committee of the Privy Council constituted as a separate department, to which appeals might be made from the local authorities, and whose duty it would be to consider the recommendations dicated by the experience of the district medical officers.

They also recommend that the appointment of proper inspectors of nuisances should be compulsory in all places, so that it should be the duty of such inspectors to report forthwith to the local authorities all nuisances which exist without waiting for the complaint of other persons.

The Committee further recommend that the medical officers of health should be irremovable without the consent of the Privy Council, and that the amount of their salaries should be subject to the approval of the same authority. The duties of these officers, if properly performed, are liable to bring them into collision with the interests of persons having influence in the vestry, and it appears of great importance that their independence of action should be secured.

It appears also to the Committee, that both the Nuisances Removal Acts, and the Metropolitan Management Acts, are deficient in not giving to the local authorities sufficient powers to oblige the builders of houses to make proper provision for drainage and ventilation.

The 29th section of the Nuisance Removal Act (18 and 19 Vict., c. 121), also requires amendment. It gives power to the local authorities to take proceedings against the owner of a house inhabited by more than one family, if it shall be found to be overcrowded; but it leaves in doubt the case where particular rooms in a house are overcrowded, as well as the case of a single family in a small house of one or two rooms. It is however to be remarked that the medical officers find it impossible to interfere as they wish with the overcrowding of houses, because of the difficulty, it should rather be said the impossibility, of the poor finding accommodation elsewhere. In this as in other details of sanitary inspection, over-strictness may become oppression, and aggravate instead of alleviating the hardships of the poor. Until more and better dwellings are provided, and until the labouring classes have learnt more fully themselves to appreciate the blessings of air and cleanliness, no sanitary regulations can be satisfactorily carried out.

The Committee in conclusion recommend to the Council:—

1. That corporations, limited owners, &c., should have increased power to sell land for the erection of dwellings for labourers, under conditions as to proper drainage, ventilation, and sanitary regulations.

2. That the public loan commissioners should be authorised to lend money, at a rate not exceeding $3\frac{1}{2}$ per cent. per annum, for building dwellings for the labouring classes, under suitable guarantees and with due regard to sanitary arrangements.

3. That in all future railway acts, and acts for local improvements, when houses inhabited by the working classes are destroyed under compulsory powers, such companies should be compelled to provide, within a convenient distance, other dwellings in lieu of those destroyed.

4. That the following amendments should be made in our sanitary laws:—

a. That the appointment of inspectors of nuisances throughout the country should be compulsory.

b. That increased power be given to the proper local authorities, to oblige builders of houses to provide adequate drainage and ventilation.

c. That the medical officers of health should be irremoveable without the consent of the Privy Council, and that the amount of their salaries should be subject to the approval of the same authority.

d. That houses in which lodgers are taken, especially where particular rooms in a house are overcrowded, should be brought under more efficient inspection.

5. That with the view of extending an accurate knowledge of the powers contained in the various acts relating to the removal of nuisances, the Council is recommended to prepare and publish a concise analysis of the existing law, calling the attention of the educated classes to this important subject, and pointing out how they may, merely by a little attention and exertion, confer most important benefits upon a large mass of working people and upon the country generally.

6. That the Council be requested to take such measures as it may think advisable to bring the first four of these recommendations as soon as possible under the notice of Her Majesty's Government.

(Signed) W. HAWES, *Chairman.*

3rd May, 1865.

TWENTY-SECOND ORDINARY MEETING.

Wednesday, May 10th, 1865; William Hawes, Esq., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Homan, Julius, 85, The Grove, Camberwell, S.
Hunt, Alfred Terrett, 1, Encombe-terrace, Wandsworth-road, S.W.

The following candidates were balloted for and duly elected members of the Society:—

Bean, Alfred W., Danson-park, Welling, Kent, S.E.
Dent, William, 21, Newcastle-street, Strand, W.C.
Gover, William, Italian-villa, Lee-road, Blackheath, S.E.
Hancock, C., 6, St. Germain's-villas, Lewisham, S.E.

The Secretary called attention to a respiratory apparatus, invented by M. Galibert, who was present and showed its action. A description of it will be found at page 440.

The Paper read was—

ON THE ART OF LAYING SUBMARINE CABLES FROM SHIPS.

By CAPTAIN JASPER SELWYN, R.N.

I venture to claim your attention this evening for the purpose of considering a subject, the importance of which, at the present moment, can scarcely be exaggerated.

A renewed attempt is about to be made to connect, by a submarine electric wire, the intelligences and interests of the old world with those of the new, and no enterprise of this age promises so much benefit to the whole human race as the realisation of such a method of instantaneous communication. The subject, therefore, may fairly be considered as one well fitted to interest the members of a society devoted to the cultivation of the Arts—the highest art being that which is calculated to benefit mankind; while, on the other hand, by no other body could the views for which a hearing is sought be more fitly stamped as current coin or repudiated as base metal. But that I am aided by the observations of some of the first mathematicians and the most celebrated engineers—of this or any other country—if I had not secured the direct support of many of the most distinguished members of my own naval service—I should scarcely have dared to advance here what might be stigmatised as crude opinions or ill-considered theories. Yet I feel that I must ask your indulgence if, while asserting some things with the enthusiastic feeling which must animate every officer of my profession who thinks that he may perchance contribute something, however small, to the solution of a great nautical problem, I should fail adequately to explain, in all cases, points where the apparently intuitive knowledge of a seaman leads him confidently to predict results for which to the landsman's mind there seems no sufficient cause.

It will readily be conceded that just as no railway could be constructed with any chance of economy or ultimate success, unless after the most careful surveys and calculations—as, again, any fundamental error in such calculations would deserve the most careful elimination—so in this great work of laying an Atlantic telegraph cable, which is immeasurably more difficult, it behoves us to examine and re-examine the bases on which we are to proceed, and to refuse attention to no suggestion, from whatever quarter it may come, until we are absolutely convinced of its worthlessness.

Among those considerations which, as I hope to show, may most favourably or most fatally influence the success of the delicate operation of laying a comparative thread of electric communication across the Atlantic, the curves described by the cable in sinking may claim the very foremost place. The question first to be solved is—Is the path of the cable during its descent to its ocean bed a straight line, an upward, or a downward curve? Is it an inclined plane? Is it a parabola with a small curve of contrary flexure? Is it, or when is it, a catenarian curve?

As no less an authority than Professor Airy has held and published the last-mentioned opinion, I will, if you please, consider that case first. A ship at rest in an ocean of two miles in depth, allows a sounding line, carrying an iron weight of 96 lbs., to run freely to the bottom. By many and accurately made experiments we find its time of descent to be fifty minutes nearly. We may treat it roughly, for our present purposes, as two nautical miles per hour. Now we can by no means expect that any telegraph cable, more especially the present Atlantic (a specimen of which is on the table), could sink at a materially greater rate. More probably it would be considerably longer in reaching the bottom. But we will assume that it sinks as fast. Then, in one hour, a cable which is being paid out without strain, will reach the bottom in two miles depth of water. If, during that hour, the ship has made a progress of only one mile, and the natural acceleration of the descending cable has not been interfered with by brakes, the curve described will inevitably be a catenarian one; and this will be the case whenever, no strain being kept on by mechanical appliances, the rate of sinking of the cable is in excess of the rate of progress of the ship. It is always thus in shallow water with heavy cables; a catenarian curve is there the invariable rule.

Next we will consider under what circumstances the cable will pursue a straight path, on an inclined plane, to the bottom. If the rate of sinking of the cable be again assumed as two miles per hour, and any rate of speed be given to the ship less than or equal to this, while a strain by brakes is placed on the issuing cable sufficient to prevent acceleration beyond the speed at which it is dragged out of the ship, then the line of descent will be a straight one, or little varying from an inclined plane. But in both these cases we have assumed a speed of ship of two miles only per hour, which in practice would be inadmissible.

We will now pass on to the case in which, as always really occurs in practice, the speed of the ship is materially greater than the rate of sinking of the cable. The cable issues from the ship, still under some strain, at from 20 to 30 per cent. in excess of her speed, which we will call five miles in the hour. That is, in one hour the ship has passed over five miles of ground, two miles of the cable has sunk, and, say, six miles of it has been paid out, or has issued from the stern of the ship. What has become of this? and in what curve, or on what inclined plane, is it now arranged? This, so far, is the real point at issue. I venture to hold that the curvature which under these circumstances takes place is an upward one, of the nature of a parabola, having a small curve of contrary flexure near the bottom, the general convexity being towards the surface. My reasons for this opinion are as follows:—First, whatever may be the speed of the ship, the rate of sinking of the cable can never be increased correspondingly, or, indeed, in any degree. Secondly, the slack paid out, averaging 25 per cent., is very much more than the difference between the horizontal distance, five miles made good in one hour, and the diagonal distance from the surface to the bottom on the same route. And this excess will certainly not be expended in producing a serpentine form, for which there is no possible cause, unless a very large proportion of slack is paid out, but in that upward curve, the cause for which is to be found in the resistance to cutting descent of the fluid through which the cable is moving. The less the sp. gr. of the cable, and the larger its diameter, the longer will be the comparatively straight part of the parabola, and consequently the more cable will be exposed to the effect of lateral surface currents wherever such exist. Indeed, a valid proof that there is a considerable portion of the cable so exposed to currents, and, therefore, that there is such an upward curve, is to be found in the fact that on several occasions the issuing cable was run away with by a comparatively trifling current, making it take an angle with the ship's course. This could not have been the case had only the small portion of cable been exposed to the effects of currents, which would be due to the cable following an inclined plane between the ship and the bottom. This upward curve would also be liable to be produced or increased when there existed a current in a direction opposed to that of the ship's progress, for thus there would be an increased resistance to cutting descent. While I thus attempt to show what is probably the curve taken by the cable, and what are the dangers attendant upon it, how it is produced, and what are its limits, I also wish to point out that, if this be the truth, there is an important advantage which may possibly be realized in case of a breakage of the cable. We all, I am sure, sincerely hope that this may not be the case, but should it occur, with proper apparatus attached to a strong hawser or line, and by steaming, so soon as the signal of rupture was heard, directly across the track previously followed by the cable-laying vessel—her consort, whose station should always be about three miles on the lee quarter, might catch the cable again before it was irreparably gone. I exhibit some apparatus for doing this automatically, and without such assistance; but there will be considerable difficulty in using it, unless by men of great nautical skill.

I propose now to consider the lateral curves, with their effects, which may be made by the cable, owing to surface currents at an angle to the ship's course. If, the ship's course being west, a surface current be entered whose di-

rection is southerly—towards south, *i.e.*—no effect can be noticed on the ship herself until, by astronomical observation, the existence of such a current is evidenced in the difference between the true and dead reckoning position; but it is otherwise with the issuing cable. It may immediately be observed to have deviated from its former line straight astern, and is now carried at a greater or less angle on the port or left-hand quarter; also, the strain shown by the dynamometer and the rate of issue will rapidly increase. Now no more fatal error can be committed by the engineer than to load the breaks, and attempt to resist this. The only remedy is to go faster, steer a current course, and get out of the current as soon as possible, yielding so much to the increased demand for cable as never to bring more than a very small strain on. But it may be objected that, by so doing, an enormous percentage of slack will be lost. It is so apparently, but not really; for, as the current is but a surface disturbance, so soon as the cable in sinking has passed through it, the line in which it is laid follows really the true track of the ship as she is carried by the current, although, while in the current, it is carried in a loop far away to leeward. This it is very difficult to explain clearly without a diagram or model, to which I must therefore refer you; but it results from the fact that the cable exposes a very large surface to the lateral action, and is not like the ship forced against it by the motive power. If we conceive a fluid surface like oil floating on water of a certain depth—that this oil is carried laterally at a given rate by a cause which does not affect the water under it; if next we imagine a cord laid over the oil and sinking first through it and then through the water, we shall be able to understand how in the oil the cord may be carried off in a loop, or bight, as it is called by seamen laterally, falling thereafter through the water in the true line in which it is laid. But, of course, this will only be the case where the current has no great depth, for if from top to bottom the whole body of water moved, there must be a uniform lateral curve, just as there is a vertical one owing to the resistance to cutting descent.

It will be useful to remember that the new Atlantic cable, having a diameter of one inch and a quarter, exposes about 633 feet of section per mile, and a two-knot current at 11·8 lbs. per square foot brings a strain upon each mile exposed to it, of over three tons. Now, as in yielding to the set of the current more and more cable will constantly be demanded, and therefore more will be exposed to it (the rate of sinking never being capable of increase), it would at first sight appear that this demand ought to be resisted; and, in the first attempt at laying, there was an instance in which this course was pursued, which, as I should have expected, resulted in the breaking of the cable. I hope that so unwise a proceeding will not be repeated. It should be a rule with those who are laying deep-sea cables, that the maximum allowable strain must never exceed one-fourth of the breaking strain, even where the cable is made comparatively inextensible by the use of longitudinal fibre or wire; but where spirals of iron or steel wire enter into the construction of a telegraph cable, not being in contact with an incompressible core, then no strain sufficient to stretch the copper wire, which is now acknowledged not to be protected from such tension by any spirals,—I say no strain, not even that due to its own weight in any great depth, can safely be borne by it. Again, the rule of the cable-maker ought to be that, his cable being hung freely in air, the weight is to be accurately observed which suffices, not to break it, but to stretch it two per cent., and on no account must more than a half of this be afterwards brought upon it.

If, after accurately calculating the number of pounds of copper per mile which will carry messages a certain distance at a certain remunerative rate, I then subject that wire to any tension which can decrease its area, and do so moreover, to an uncertain extent, at any place where the wire, although seven-stranded, happens to be unusually soft, I might as well not have calculated, for I cannot secure the result. Therefore, even one per cent. of stretching is to be avoided if possible. There is no other way of doing this than by adopting either straight steel wires, enclosed in an elastic compound, as in Mr. Macintosh's cable, or less perfectly, but probably sufficiently near inextensibility, by the steel spiral in contact with the incompressible copper conductor of Mr. Allan.

The next branch of my subject to which I will beg your attention is the formation of kinks. The causes for their formation are various, the process of coiling and and uncoiling being the first. The means of avoiding those so caused, while securing many other advantages, I have so often brought before the public that it would unnecessarily detain you if I were to do more than point out the model and diagrams of the floating cylinders which I have always consistently advocated. But there are other causes for kinks which might be avoided. No treatment could well be more unfavourable for a telegraph cable than that of forcing it to pass round comparatively small drums from four feet to eight feet in diameter, as brakes under a heavy strain, and none could be found more certain to induce the formation of those kinks which are so much to be dreaded. Now, kinks thus formed may occur under water, after the cable has been lost to sight in the waves, and this will happen most often when the ship is pitching, and so suddenly slacking up the cable which then, not being able to sink faster than it did before—being, in fact, partially waterborne—arranges itself into a curve such as it had when tightened round the drum. The next upward pitch produces a kink which may, if it does not break the cable, yet cause inside the elastic sheath solution of electrical continuity. This recovers itself temporarily at the end of an hour or so, when the strain is taken off by the approach of that part of the cable to the bottom and the ends of the broken copper wire come together again, only eventually to be destroyed by the accumulation of electrical resistance at that point.

Now this can be in part avoided by the use of an elastic connection for the retarding apparatus—I will not call it by the ill-omened name of brake—nor should it be in any way similar to those machines which have been hitherto used for such purposes, but rather like the human hand with the difference that the rubbing surfaces must be rolling surfaces also. By such means there must be established a continual give and take of the cable whenever the ship is pitching heavily, as even the *Great Eastern* may do if she gets a sea on the quarter or bow. It should not be forgotten that the danger of bad weather will, in this instance, be double what it was in the *Agamemnon's* case, because the time occupied by one ship in laying must necessarily be twice as great as when two are employed starting from the mid-Atlantic.

I am sure that every one who is interested in the spread of Ocean Telegraphy, not alone those who are pecuniarily interested, but also that far larger body who feel that the more rapid communication of thought must sensibly influence the happiness of the whole race (and to that body who does not belong?) unite in wishing success to the renewed attempt to unite England and America by an electric cable. Of the advantages to the fortunate company who shall succeed we have often heard; there is little doubt that one year's good work would pay the whole cost. But immediately after such success ocean telegraphy would stride where hitherto it has only crept, and then we all trust that each who has some idea on the subject which would secure diminished risk or cost, will have a fair chance of seeing (if it be really good) his pet project brought into practical use. Now my pet is a drum, not, as you have heard tonight, a small one, but one so large as to have been objected to on that score, and which I have promised you not to beat to-night. But you will not, I am sure, object to my mentioning another pet, of quite a different character. No one deserves more credit in connection with submarine telegraphy, for the money they have

expended and the perfection they have attained, than the manufacturers of insulating substances; and I fully believe that whatever was possible has been done by the India rubber manufacturers for caoutchouc, and by the Gutta Percha Company for their admirable gum. But new materials of hitherto unattainable qualities must make themselves felt in every social want, and the discovery of paraffin, and its power of combining with India rubber in small proportion, bids fair to revolutionize the whole system of insulating cables. Not only is the insulation better, but the inductive capacity is less than the best virgin Para rubber, while, for plasticity and durability, it surpasses any gutta percha. More than this, the price at which it can be manufactured will leave these gums far behind, and its general adoption can only be a question of time.

I will conclude by saying that, in my opinion, there ought to be no difficulty in laying telegraph cables wherever required; that there is no reason whatever for preferring along shore lines, but the contrary; and that if we can only hail the success of the Atlantic cable this year, half-a-dozen more cables will immediately be required. I hope that the questions I have raised here on this occasion will have a value stamped on them by discussion such as my feeble efforts could never give; and thanking you for your kind attention, I trust you will believe that my aim has been and will always be "to assist a known friend in view," in the language of the Articles of War, to the utmost of my power and ability.

DISCUSSION.

Mr. Varley expressed his opinion that the cylinder or drum introduced by Capt. Selwyn, for the purpose of laying submarine cables, was the best plan that could be adopted, as the cable was thus subject to less mechanical disturbance than was occasioned by the means usually employed. The merits of Capt. Selwyn's system were, in his opinion, so great, that he wished it every success.

Mr. C. W. Siemens said they must all feel much indebted to Capt. Selwyn for having brought this subject so fully and ably before them. He (Mr Siemens) could not, however, go so far as to say he entirely agreed with him in all his statements. The curve made by the cable while being laid was no doubt a very important consideration in dealing with this subject, and he did not agree with Capt. Selwyn that its form was such as he had described it to be. He thought it was capable of demonstration, that when a ship was proceeding at a uniform rate of speed, and paying out a cable of fixed density, the latter must descend in a direct inclined plane. Capt. Selwyn had stated that the moment the cable left the ship it would commence its downward course, at the rate of about two miles per hour; then, if the ship was going at six miles an hour, the inclination at which the cable would remain would practically be 1 to 3, or if it went at four miles an hour 1 to 2, or if at two miles an hour 1 to 1; so that, unless the velocity of the ship changed, the cable must descend nearly in a straight line. Then came the question why it was found impossible in practice to do without a certain retarding force during the operation of laying. While the cable was, as it were, sliding down the inclined plane, the force exerted was so great that, if it were not resisted, it would cause the cable to run out with such velocity as to produce an immense waste of cable. When it got to the depth of 1,000 fathoms the force with which the cable ran out was very great indeed, and it required to be resisted, otherwise twice or thrice as much cable as was required would be paid out. He thought it was of comparatively little importance what method of paying out was adopted so long as it was a safe one, affording the means of varying the retarding force at will. It appeared to him that the great point was to make the apparatus as simple as possible, so that no kinks or other disturbances could arise. With regard to the measure of the retarding force, that would depend entirely upon the specific gravity of the cable and the depth. The laying of a heavy iron-coated cable in 2,000 fathoms water was a difficult and critical operation. One of very small specific gravity might perhaps go out nearly in the upward curve described by Capt. Selwyn; and if it did so, although there was no retarding power acting upon it, there would be danger that sufficient slack would not be produced at the bottom. Then came the considerations as to the nature of the bottom. If the cable were laid along a great plateau, then moderate slack was sufficient, but with a precipitous bottom, it was difficult to lay out sufficient slack for the safety of the cable. He would mention a case which came within his own knowledge. A cable had to be laid not far from the Spanish coast, and, according to the soundings previously taken the bottom descended in a slope of about one in four, but it turned out that in reality the shore was very mountainous, and of a volcanic nature. At about eleven knots out at sea, there was a deep valley with precipitous sides. The depth of one edge of this valley was about 700 fathoms; of the valley itself 1,600 fathoms, and of the other edge 900 fathoms, so that the cable was suspended between the two precipices, involving great danger of rupture, which actually did take place shortly after the cable had been successfully laid. In cases where such gulfs were known to exist, the only safe plan was to stop the ship, and allow the cable to run out so as to furnish enough to lie on the bottom at every point, however deep. This was a serious source of danger, against which it was important that every precaution should be taken. Deep sea soundings were not generally taken at sufficiently frequent intervals, and cables were seldom laid in the line of soundings.

Mr. Thomas Allan felt much obliged to Capt. Selwyn for bringing forward this interesting paper on the art of laying submarine cables, but it occurred to him (Mr. Allan) that the solution of that problem involved the solution o another, viz., that of the art of making the cable itself. Cables had been made, and were being made, every day, which, so far as their electric conditions went, were suitable for communication with the other side of the Atlantic. The last Atlantic cable, when constructed and on board ship, did its work well enough; but before it got well to the bottom of the sea its occupation was gone, or it experienced such an amount of deterioration, that after it had lain a short time on its ocean bed, it "gave up the ghost," and ceased to be of any use. His own opinion was, that the first element in a deep sea cable was that its specific gravity should be so low that the apparatus required for the laying of it should be something wholly different from what had hitherto been employed. Up to the present time it was a misnomer to say cables were paid out. They were, in fact, dragged out, and were always kept on the stretch, so that (as had been described by Mr. Siemens) on crossing a chasm they were suspended from one point to the other, at the risk of great injury. Hitherto, the main point in the construction of a cable appeared to have been to enclose the electrical conductor in one of two destructible materials—iron or hemp—or in both together. For his own part, he thought it an absurdity to employ a destructible material like iron to protect an indestructible material like gutta percha. It had happened in the Mediterranean that cables after being laid for a short time had ruptured, probably from having been suspended over a chasm, but if these cables had not been burdened with such heavy materials they would probably have remained so suspended, and no destruction of the electric continuity have taken place so long as the gutta percha remained sound. If a cable of sufficiently low specific gravity were made, the operation of paying it out would be an easy one. It might be pitched out of a ship as a fisherman would throw a line from a reel. There ought to be no strain put on it, and it should be let out at a rate 14 or 15 per cent. faster than the speed of the ship, so that it might find its way to the bottom in its own good time. There was no reason why it should not arrive at the bot-

tom of the sea in the same electric condition as when it left the ship. A shallow water cable was a different thing altogether, and called for a different mode of construction. Results proved that nearly all the cables made of a single conducting wire had been failures, while the multiple wire cables between this country and France and Holland had all been successful, simply because, as shallow water cables, their mechanical construction was correct. Of the 15,000 to 17,000 miles of cable laid up to the present time, there were not more than 4,000 miles in working order, and 2,500 out of the 4,000 were of the type of the present Atlantic cable; but that type of cable, wherever it had been attempted in deep water had failed from the stretching. He very much regretted, notwithstanding the experiments instituted by the Government commissioners, that that form of cable had been decided upon for the Atlantic route. The same type of cable had been adopted from Toulon to Algiers and Corsica, and both had failed. In the first place there was considerable difficulty in laying it, and though it was made of comparatively low specific gravity, so as to make it suitable for deep water, it kinked to a great extent. The late Atlantic cable was of such a construction as to be liable to stretch, and that impaired its conducting power. He sincerely hoped the present cable would be successful, but he could not say he had much confidence in it—many causes might rupture it before it got to the bottom, and even if it arrived safe there he was afraid it would not satisfy the requirements of the public.

Dr. BACHHOFFNER remarked, with reference to what had fallen from the last speaker, that they had been told by Capt. Selwyn that he believed if the present Atlantic cable succeeded the whole cost of £800,000 would be repaid in one year, but from what had been said by Mr. Allan, who was a great authority on these matters, the failure of that enterprise might be looked for long before the £800,000 was earned. Mr. Siemens, who was a great authority in the laying of cables, differed from some of the statements made by Capt. Selwyn, and had put a very remarkable case before them in support of his own views with respect to the great valleys or gulfs met with at the bottom of the sea. Mr. Allan had spoken in favour of cables of low specific gravity, but he (Dr. Bachhoffner) thought that was hardly the type calculated to withstand the great resistance which a long cable like the Atlantic would meet with. The casing of a cable with iron was desirable—first, for obtaining a certain degree of specific gravity, and secondly, to withstand any injury it might meet with when laid down. There was one circumstance connected with this subject which had not yet been noticed. They were told on the preceding evening in this room, by Dr. Crace Calvert, of the effects that were produced upon iron by friction and percussion, by which a body not crystalline in its natural condition became so by constant motion, and the familiar example of the crystalline state of the axles and tires of locomotives was given in support of that view. Some years ago he was much engaged in manipulations with large voltaic batteries, the wires of which were as thick as a goose-quill, and composed of the best and most flexible quality of copper, but after a few months' use those wires became so brittle that they broke off short like a piece of dry stick. He thought it was generally admitted that the action of electricity through these conductors was a vibratory action, and not a direct transmission of the force. It was by molecular action that electricity was conducted through the wire, owing to which it resulted that the wire became in a short time converted from a fibrous into a crystalline state; and he believed it would be so with the electric conductors in cables, in proportion to the work to which they were subjected, or in proportion to the amount of electricity transmitted; and thus there might be danger that, after long use a very slight accident in the water would easily cause rupture. Capt. Selwyn had mentioned the curious circumstance that a cable in being paid out might be so stretched as to cause an interval between two points of the conducting wires, but that as the cable contracted again after it was relieved of the strain these would be brought together again. That was alleged to have been the condition of the late Atlantic cable. They knew if there was an absolute break of continuity of the conductor only a small spark would be transmitted from one point of severance to the other, and eventually so much oxydation would take place as to destroy the conducting power of the cable.

Mr. MACINTOSH said he thought that, from the care the electrician was taking in testing the new Atlantic cable in tanks under water, there was no doubt that, when the *Great Eastern* left Valencia for Newfoundland, the electric tests would be perfect. The paying-out apparatus was of an exceedingly delicate character, and he believed a tolerably accurate survey of the bottom had been made, so that he had little doubt but that the cable would remain practically useful for some time at least. The tarred hemp covering would, however, cause great delay in the sinking of the cable, particularly if it met with surface currents. If the *Great Eastern* encountered bad weather, the heaving up of the stern would be great, inasmuch as, if a sea struck her on the quarter, she would not get away from it, simply because she could not travel, during the paying out, at more than six miles an hour; therefore, unless her brakes were very delicate, there must be a severe strain upon the cable. He thought, moreover, that the insulating medium employed was faulty. A microscopic examination of gutta percha showed it to be full of impurities. Those impurities, so long as they remained dry, were non-conductors, but the moment they became hydrous, they were conductors, and hence, he thought, the cable must, after a time, fail. There were, however, compounds such as paraffin, which could be obtained as pure as virgin wax, and the insulating qualities of which were superior to the purest indian rubber. It was, moreover, well known that paraffin was unalterable, that it was unpalatable to marine insects, and that it was exceedingly cheap. If they succeeded in laying this Atlantic cable, expensive as it was, the great demand that would be created for intelligence from across the Atlantic would stimulate others to prepare cables of a more suitable mechanical structure, and he had no doubt there would be four or five cables across the Atlantic within a comparatively short period. He therefore hoped that every judicious step for the success of the present enterprise would be taken by those in charge of it, for it would be a most unfortunate circumstance for the community at large if any mishap took place.

Capt. SELWYN said he had promised not to speak of his cylinder; but he had brought a model of it, in order to illustrate his theory of the curve taken by a submarine cable, as nearly as he could do so without the water. It was quite clear that with a rope or piece of twine he could not fitly represent the resistance due to a body passing through water. He was therefore compelled to resort to a lighter and broader substance, consisting of the riband of paper, usually employed for printing telegrams, wound on to a reel, so as to give a certain per-centage of slack, but nothing like that given in laying out a cable in practice, and as the reel passed from one side of the room to the other, it would be seen that the curve described was an upward curve. There could be no better proof afforded that the resistance over a large surface of cable was something considerable, and that it could not follow, under these conditions, the inclined plane, the existence of which not only Mr. Siemens but other men highly placed in science, would have us believe. He (Capt. Selwyn) brought to bear on this subject his practical knowledge, extending over five-and-twenty years, in the use of ropes and in deep-sea soundings, and he had no hesitation in stating that the result of his experience was a belief in the curve which he had described. [The action of the model of Capt. Selwyn's cylinder was then exhibited by passing it several times across the room upon wires stretched as bearers, and the riband of paper

took the upward curve, as described. Capt. Selwyn then went on to remark that the chairman had informed him that the speed at which the model had travelled in this illustration was as near as possible six miles an hour, and thus it approached sufficiently near to the rate at which a cable was laid in practice. Mr. Siemens, in speaking of the curves, inferred that he (Capt. Selwyn) advocated the doing away with the retarding power over the cable. That was not so. The paddle-wheels of the cylinder were capable of exerting when necessary a very considerable retarding power; as long as the ship towed the cylinder a-head those brakes did not act, unless there was a pull upon the cable, which tended to produce a rotation of the cylinder in excess of the rate at which the ship was travelling, and that rotation was resisted by the beating of the paddles against the water. In point of fact he substituted water-brakes for the mechanical brakes, by which he believed no little mischief was occasioned to the cables that had been already laid. With regard to the precipices in the bed of the ocean referred to by Mr. Siemens, they were told, soon after the laying of the Atlantic cable, that there was a precipice on the shore of Ireland which led to the rupture there. In order to ascertain the matter, he went over the soundings with the late hydrographer, and he found the descent was only 1 in 16, being a little less than Holborn-hill. That there were such precipices as Mr. Siemens had described, in volcanic regions and on rocky coasts, there could be no doubt, but that was a warning to avoid such places in laying a cable, and by proper survey to ascertain that no such places existed along the path on which the cable was intended to be deposited. He had been much engaged in marine surveying, and he would say that any one employed in that work, who left unnoticed such a gulf as that described by Mr. Siemens, deserved much blame. Such a thing could not occur if the most ordinary care was exercised in surveying the ground before attempting to lay a cable upon it, and no engineer should be allowed to lay a cable where a surveyor had not preceded him to ascertain, with the utmost attainable accuracy, the form of the bed of the sea. With regard to the friction of the cable on these precipices (supposing it to have been laid on a badly selected route), he would point out that the heavier the cable was, the more mischief there was from friction; if it were not so heavy as to be incapable of being moved by the currents (a condition impossible of attainment in deep sea cables) then the weight was the most important element in producing damage by friction, having to be multiplied into the velocity of that friction. A cable of the specific gravity of gutta-percha, exposed to friction on a hard rock at the rate of 2,000 movements per minute, for a space of two feet, would last fifty times as long as one with an iron covering in the same situation. Here we had nature going before us. We had her anchoring her submarine vegetation to the stones and rocks in the bed of the sea, and allowing them to trail for long distances, and to be influenced by the ebb and flow of the tides. During that time they were subjected to great friction, but in no instance were they ever cut through, simply because they were not heavy, and the friction which would otherwise have destroyed them did not take place. On the shores of the Falkland Islands, and off Cape Horn, he had seen fuci (the *fucus maximus*) rising from a depth of 60 fathoms to the surface, with trunks as large as many of the oak trees met with in this country, and of such strength that ships which had dragged from their anchors had been saved by getting amongst the branches. They were made like the reed, which would bend to every storm, but more successfully resisted it than the oak. His friend Mr. Allan had happily found out that the making of a cable was so simple a matter that he was inclined to think the laying of it was an equally simple proceeding. On that point he was compelled to join issue with him; but he had no doubt when a cable of such moderate specific gravity as Mr. Allan advocated was used, there would not be very much difficulty in laying it. There would be no kinks owing to the construction of the cable itself, and there would be much less difficulty in laying it than a spirally-covered cable. Dr. Bachhoffner had spoken of the resistance to friction, and he had already answered that point as far as he was able. With regard to the crystallisation of the conducting wires, that was known to electricians as the burning of the copper wires, and wherever, from the small area of the wire or the too great tension employed, the current was unduly retarded, this effect was produced. With a fine platinum wire the resistance was so great that it was brought to a white heat, and was destroyed under a current which would pass through a given area of large copper wire without resistance or heating. The coils used for magnetic purposes were liable to be heated if a current of too great tension were passed through them. It was a question how far the area of the conducting wires was diminished by mechanical violence below that which had been calculated by the electrician as necessary to avoid such crystallisation as Dr. Bachhoffner had spoken of. With regard to paraffin, which Mr. Macintosh had alluded to, he (Capt. Selwyn) had, in company with more competent persons, closely tested the compound of paraffin and india rubber; and he believed the whole of what had been claimed for it was borne out, so far as the electrical conditions were concerned. The indestructibility of the compound could only as yet be inferred, but paraffin was in itself a substance which, as its name implied, had no affinities, and was not liable to the same process of decay as other substances having those affinities. Amongst those substances he gave the foremost place to iron wire, which oxydised under salt water with great rapidity, but hemp in contact with iron wire was destroyed even more rapidly. The use of tar only slightly retarded the decay. Where the spiral iron wires were surrounded by hemp, the destruction of the latter left them loose round the gutta percha; indeed the iron wire spiral was nothing more nor less than a most insidious enemy to the gutta percha and the copper conductor. Whether as regarded weight, producing friction on the bottom; whether as regarded the destruction of the hemp and the coincident oxydation of the iron wire, producing a number of sharp points which might destroy the gutta percha; or whether as regarded the expense, according to his views, the use of iron spiral coverings for deep sea submarine cables was wholly unjustifiable. He would rather see a simple gutta percha and copper wire cable than such an one. Though by no means saying that such would be the most perfect form, he believed there would be more chance for its durability in deep sea communication if the specific gravity were carefully studied. He was rather disappointed that the mathematical question involved in the curves had not met with a more able exponent than himself during the discussion. He conceived the curve was capable of being reduced to a true mathematical expression of the forces brought into play, and the Atlantic Telegraph Company might derive great benefit from those curves being ascertained before they proceeded with the laying of their cable. He hoped every precaution would be taken, for the interests at stake were very great, and upon the success of the enterprise depended the future of telegraphy, whether it should advance now or half a century hence, for if the present scheme broke down they might say good-bye to telegraphic communication with America, except through Russia, for a long time to come.

The Chairman said it was now his duty to ask the meeting to give a cordial vote of thanks to Capt. Selwyn for the very interesting paper he had favoured them with. A topic more worthy of discussion could hardly have been brought before them, considering the importance, both in a political and commercial point of view, of facilitating the communication with America. He agreed with Capt. Selwyn that if another £800,000 were lost, a third would

be forthcoming to try the experiment again. It was hardly possible, even if this next attempt failed, but that some further practical experience in these matters would have been gained by the failure, and even if another £800,000 was lost, the question of communication across the Atlantic was of such immense importance to the public that it was worth all this cost. When the commercial public were tired of the question, the governments must take it up. When all the science and all the great professional intellect of the country was being brought to bear on this subject, unless there were some at present unknown physical difficulties in the way, the time could not be far distant when an electric communication between America and England would be completed. Those who had taken part in this discussion had travelled a good deal away from the real subject brought before them, for Captain Selwyn did not open the question as to the merits of the different forms of cable. He (the chairman) thought it was to be regretted that some gentlemen present had expressed so strong an opinion on the merits of the cable now about to be tried under the auspices of eminent men, without having given notice that such a discussion was to arise, and without giving an opportunity for answering the statements so made. He was sorry that this *ex parte* discussion had taken place at a time when the public were looking to the completion of an enterprise fraught with such great results to the community. Nothing should be done to throw cold water upon the undertaking, but rather everything to encourage it. If it failed, those who had supported it would be the sufferers, and we should have to thank them for the experience gained, which might lead others, if not themselves, to a more successful result. There was one other point connected with this subject which he would just touch upon, that was the question of the survey of the bottom of the sea along the course where it was intended the cable should be laid. Many present, no doubt, recollected an occasion when some of the various surveys of the Channel were shown in that room. From them it appeared to have an almost perfectly level bottom; but he had heard it stated that much of this surveying was mere guess-work, and therefore that it was quite impossible, with such soundings, to say accurately what kind of surface was met with at the bottom of the ocean. Capt. Selwyn had, however, informed him that in the case of the Atlantic the soundings were complete and reliable for every ten miles of the whole route to America. If that were so they could hardly anticipate a casualty like that referred to by Mr. Siemens; but in the Mediterranean and other places the soundings might be only ten miles apart and yet there might be intervening rocks or precipices which would tend to injure the cable. He now called upon them to thank Capt. Selwyn for his admirable paper, and for the very lucid manner in which he had explained his views on this important subject.

The vote of thanks was then passed and acknowledged.

Proceedings of Institutions.

Examination of Soldiers.—The following circular memorandum (Gen. No. 331), addressed to the army at home, has been issued:—"Miscellaneous 1 (1865).—The Field Marshal Commanding-in-Chief desires it to be notified that there will be no objection to soldiers, their wives, and families, being permitted to present themselves for instruction and examination at the Educational Institutes in connection with the Society of Arts, on the understanding that they are not on that account to be exempted from any military duty, nor, except in special cases, to be out of barracks after watch-setting or tattoo.—By command of his Royal Highness the Field Marshal Commanding-in-Chief. James Yorke Scarlett, Adj. Gen.—Horse Guards, S.W., 11th March, 1865."

Newcastle-on-Tyne Mechanics' Institution.—On Wednesday, the 19th April, Sir George Grey laid the foundation stone of a new building for the Mechanics' Institution at Newcastle-on-Tyne. Several members of Parliament were present at the ceremony. In the evening a public meeting was held, over which Mr. Headlam, M.P., presided. An address of thanks was presented to Sir George Grey for his services at the ceremonial in the morning. Sir George Grey, in replying, referred to the origin of the society, now forty-one years ago. It was established in February, 1824; and its members felt pride in the names of those men under whose auspices it then was formed, and afterwards attained most distinguished eminence, and of which Newcastle and Northumberland were justly proud. To one in particular reference might be made—George Stephenson; and he was sure he only expressed the common wish of all who heard him when he said they earnestly desired that this one name might be handed down to successive generations of thousands worthy of the great man whose fame is identified with this part of the country, and who, amidst all his engrossing occupations and his world-wide fame, never lost the deep interest he took in this institution, because he believed it was calculated to confer inestimable benefits upon the class from which he sprang, and with which he never lost his connection. Another name he would also refer to—that of Lord Brougham, which could never be mentioned without honour in connection with Mechanics' Institutions, for which he had done so much, and in which he still retained the warm interest he ever felt in all that concerned the intellectual improvement of the people. Referring to the changes, political and commercial, which had taken place during the forty years since the institution was founded, Sir George Grey alluded to the repeal of the corn-laws, and the part taken by Mr. Cobden in this beneficial change. One of the greatest proofs of progress was the increase in the means of education. The means of carrying out the education of the working-classes was now extended to a degree which he believed the most sanguine friend of education forty years ago could not have anticipated. Education, however, was a life-long work, and consisted in availing oneself day by day, in the intercourse of ordinary life, of the means of increasing knowledge by reading, reflection, and intercourse with other men. And here it was that Mechanics' Institutes and libraries were found to be so valuable; there were few who had not some time to give to mental culture; but how many were there who had not the means of access to libraries and books from which to derive that instruction which they desired to obtain. Mechanics' Institutions and kindred associations placed within the reach of every individual man those means of education which, isolated and separated from the institution, he could not possibly obtain. In those Institutions a man might avail himself of that knowledge the means of acquiring which he had already obtained in the primary schools. These institutions gave a man an object worthier of his higher nature, and kept him from indulgence in those debasing pleasures which destroyed his domestic comfort, ruined his health, and too often ended in shame, misery, and crime. Would that these advantages were more generally appreciated. He trusted that, in this district, they were so. Referring to the recent differences between the masters and their workmen, he said he believed that the more the influences of these Mechanics' Institutions were extended, the more the means of knowledge conferred by these Institutions pervaded the mass of the people, the less chance would there be of those differences leading to consequences which all must deprecate.

DUBLIN INTERNATIONAL EXHIBITION.

The Exhibition was formally opened by His Royal Highness the Prince of Wales on Tuesday, the 9th inst. His Royal Highness arrived at about half-past two

o'clock, accompanied by the Duke of Cambridge, and attended by the Lord Lieutenant and Lady Wodehouse, Earl Spencer, and Sir Robert Peel, and was conducted to the dais which had been prepared for him.

The National Anthem having been performed, the Duke of Leinster read the following address:—

"To His Royal Highness Albert Edward, Prince of Wales, Earl of Dublin,—May it please your Royal Highness—For the distinguished honour of your Royal Highness's presence here this day, we, the Exhibition Committee, desire to offer our humble thanks. It is difficult for us to give expression to the feelings of joy and loyal satisfaction which fill the hearts of all who throng these halls to witness the inauguration of the Dublin International Exhibition of 1865 by your Royal Highness in the name of our beloved Sovereign. In this mark of favour and approval we discern not alone the Queen's high appreciation of the interests of industry and art, but especially her Majesty's gracious wish to promote the success of every enterprise which tends to advance the welfare of the Irish people. The act which your Royal Highness is about to perform cannot fail to remind us of the enlightened encouragement which the illustrious and lamented Prince Consort bestowed upon every work of usefulness, and especially upon undertakings like the present. International Exhibitions, bringing together the various nations of the earth, and making each better acquainted with the wants and with the resources of the rest, directly tend to stimulate industrial energy and increase commercial interchange, and, binding all people together by the ties of mutual interest, they become in no small degree the auxiliaries of peace and progress. The fine arts now occupy a prominent place in international exhibitions; the display of the best works of renowned artists opens up new sources of pleasure and delight, and forms a most important agent in the education of the people. We trust that the Exhibition at whose commencement your Royal Highness so graciously presides may prove not unproductive of such beneficial results, and that it may justify the hopes of those who, in honest labour and in self-reliant enterprise, recognise the true sources of national prosperity. We cannot conclude without expressing our heartfelt wishes for the health and happiness of your Royal Highness's illustrious consort, whom the Irish people earnestly desire to see amongst them. Whenever circumstances may permit her Royal Highness the Princess of Wales to visit our shores, which we trust will be at no distant period, we venture to promise such an enthusiastic welcome as will convey to her Majesty and to your Royal Highness the fullest assurance of loyalty and devotion."

To this address his Royal Highness was pleased to return the following reply:—

"My Lords and Gentlemen—I thank you for your address. It is a source of sincere pleasure to me to discharge the duty which has been confided to me by her Majesty the Queen in thus inaugurating your Exhibition. It is not less in accordance with my own feelings than with those of her Majesty to assist in every measure which is calculated for the happiness and welfare of the Irish people. The example of my lamented and beloved parent will, I trust, be ever present to my mind as a stimulus to the encouragement of every work which is calculated to advance international prosperity and to develop the resources of my country. The cultivation of the fine arts, in itself so powerful an auxiliary in civilising and refining the human race, has been an important object in this Exhibition, and seems already to have produced most satisfactory results. Believe me to be very sensible of your kind wishes on behalf of the Princess of Wales. Her regret at not being able to accompany me only equals my own; and you may rely on her anxiety to come among you assured of the welcome she will receive."

The Old Hundredth Psalm was then performed, and at its conclusion Mr. Gilbert Sanders, chairman of the Exhibition Committee, read a report giving a history of the Exhibition Palace.

Mr. Parkinson (comptroller) presented to the Prince the key of the building. The Coronation Anthem was then sung, and at its conclusion an address was presented by the Lord Mayor of Dublin, to which his Royal Highness replied.

The "Heavens are Telling," from Haydn's *Creation*, was then performed, and at its conclusion the procession made the tour of the building. On the return of the Prince to the dais, the opening chorus from Mendelssohn's *Hymn of Praise* was performed. At its conclusion His Royal Highness commanded Sir Bernard Burke, Ulster King-at-Arms, to declare the Exhibition open.

SOCIETY OF ARTS PRIZE COTTAGES.

The following correspondence on this subject has appeared in the *Builder* of the 29th April and 6th May:—

The following is the result of a trial to get cottages built on the plan described in your number of the 31st of December, as having obtained the Society of Arts prize, and as estimated to cost £203 a pair.

The cottages to be built were six in number; the locality was Bishop's Stortford; and the very best means were taken to ensure that the plan and specification should be in strict accordance with the ideas of the designer.

Six tenders were obtained: three from London builders and three from the country. They were—

Perry, Stratford, London	£1,193	or	£397	13	4	the pair
Bell and Sons, Cambridge......	1,272	or	424	0	0	,,
Glasscock, Bishop's Stortford...	1,380	or	460	0	0	,,
Freeman and Sons, Ely	1,388	or	462	13	4	,,
Pattrick and Sons, London ...	1,392	or	464	0	0	,,
Hill and Keddell, London......	1,581	or	527	0	0	,,

So that the lowest tender was nearly twice as much as the estimated cost of the prize cottage; the low estimated cost being, I presume, one of the principal grounds of awarding the prize to it.

Any one can build a good labourer's cottage: the difficulty is to build one for little money. I have had occasion to build hundreds, but could never build one that a decent family should live in under £140 or £150 a single cottage.

ROBERT SINCLAIR,
Engineer-in-Chief, Great Eastern Railway.

With reference to Mr. Sinclair's letter in the *Builder* of the 29th ult., I feel called upon, as the author of the design referred to, to state that the plans and specifications upon which the estimates obtained by Mr. Sinclair were based, were, as indicated in his letter, prepared by me, and embodied not only the improvements and additions suggested by the judges in their report, but also such other improvements as had occurred to me since the preparation of the original design, in order to make them complete in every respect, without special regard to the estimated cost. It cannot therefore be expected that the estimated cost of the original design will bear a favourable comparison with the tenders obtained by Mr. Sinclair for the altered and improved plans and specification furnished to the company.

I may mention that, further than the preparation of the said plans and specification, I was not professionally employed, being quite unacquainted with the locality where the cottages were intended to be erected, and the nature of the site, and had not even heard the result of the tenders until observing Mr. Sinclair's letter.

Unquestionably the tenders obtained by Mr. Sinclair are high. Had a greater number of builders in the immediate neighbourhood, and in a much smaller way of business, been applied to, the result would, I have little doubt, have proved more satisfactory.

I have lately had occasion to obtain several estimates

from local builders for similar cottages which I am now erecting upon an estate on the borders of Kent and Surrey (about nine miles across country from the nearest railway station), the result of which I beg to subjoin :—

R. Ward, Warlingham	£312	0	0	a pair.
Kesterton and Head, Lingfield	287	10	0	,,
R. Bellchambers, Westerham	285	0	0	,,
F. Shorter, Edenbridge	259	18	0	,,
G. Crane, Cudham (accepted)	216	0	0	,,

These estimates, however, were framed upon a plan and specification embracing the improvements suggested by the society, besides plastering and colouring to walls (not included in my original estimate), but with certain modifications in regard to the offices ; *i. e.*, dispensing with the w.c. apparatus, lead pipes, cistern, force-pump, and well, and substituting a rain-water tank, 5ft. diameter and 8ft. deep, with pumps, privies, and cesspool at end of garden, and including the cost of a piggery to each cottage, which, however, has been dispensed with in the tender accepted. Neither the timber for the roof nor the cartage of materials is included in the contract, the value of which, when added to the lowest estimate, will represent a sum close upon £260, the actual cost of the cottages per pair to the proprietor, bearing a favourable contrast with the average cost of good cottages, with similar conveniences, stated in the report of the judges previously referred to.

It will be observed that the locality where these cottages are being built is by no means easy of access; and it may be reasonably inferred, that under more favourable circumstances a considerable saving might be effected in the carriage of materials, an item of much importance in cottage building.

John Birch.

ROYAL SCOTTISH SOCIETY OF ARTS.

The above Society proposes to award prizes of different values, of thirty sovereigns and under, in gold or silver medals, silver plate, or money, for approved communications primarily submitted to the Society by fellows or others, relative to inventions, discoveries, and improvements in the mechanical and chemical arts in general, and in their relation to the fine arts, and also to means by which the natural productions of the country may be made more available. The Society suggests the following as a few of the many subjects that may be attended to, viz. :—

I. Inventions, Discoveries, or Improvements in the Useful Arts.

1. *Mechanical Arts.*

Inventions or improvements in applying the motive power of men and animals—in wind and water prime movers—in steam and other heat engines, including gas engines—in pumping, blowing, rolling, sawing, agricultural and other engines and machines—in cotton and other textile manufacturing mills—in ship-building, wood, iron, and steel—in lighthouses—in marine propellers—in railways, plant, and signals—in electro-magnetic motive power—in electric and other telegraphic apparatus, submarine and aërial—in photographic apparatus—in fire-proof buildings—in water-supply—in paving—sewerage—in economical appliances for increasing the sanitary condition of towns—in smoke consumption and extinguishing fires—in gas-works—in canals and inland navigation, including the application of steam-power to canal traffic—canal locks, inclines, and lifts—application of hydraulic power for lifts for domestic use—for cranes—printing presses—organ-blowing, and other similar purposes, where small propelling power is required—labour-saving machines for working in wood—in tools, implements, and apparatus for the various trades—in bricks, encaustic tiles, cements, and mortars—in printing machines, cases, and rollers—in stereotyping—in cranes—in the machinery for collieries—in preserving timber and metals in marine works—in optical apparatus for astronomy, surveying, and levelling—in manufacture of paper—experiments on the effect of low temperatures on metals.

2. *Chemical Arts.*

Inventions or improvements in new and useful applications of gutta percha and vulcanised india rubber, or similar gums—in the economical extraction of chemical principles or useful substances, as paraffine, &c., from coal—porcelain clay from granite or felspar—and metals generally from their ores and oxides—in dyes—in paints—in paper—in glass, especially for lenses—in methods of rendering the electric light available in practice.

3. *Relative to the Fine Arts.*

Inventions or improvements in photographic processes, in "carbon" printing, and in methods of printing photographs from their impressions on steel or copper-plates, or lithographic stones—in electrotype processes—in die-sinking—in methods of illustrating books, to be printed with the letterpress—in paper-hangings—in articles of porcelain, common clay or metal—in glass-staining—in engraving on stone—in chromo-lithography—in "Nature" printing.

4. *Natural Productions.*

Discovery of plumbago mines—whetstones—of woods suitable for engraving.

II. Experiments applicable to the useful arts.

III. Communications of processes in the useful arts practised in this or other countries, but not generally known.

IV. Practical details of public or other undertakings of national importance, already executed, but not previously published ; or valuable suggestions for originating such undertakings.

The Keith Prize, value Thirty Sovereigns.

For some important "Invention, improvement, or discovery, in the useful arts, which shall be primarily submitted to the Society" during the session.

The Hepburn Biennial Prize, value about £12.

(*If not awarded during Session* 1864-65).

"For such inventions or communications submitted to the Society as shall be approved of by the Society, or by their Prize Committee."

The Makdougall-Brisbane Biennial Prize, value £10.

(*If not awarded during Session* 1864-65.)

"To the authors or inventors of communications of merit, which shall be approved of by the Society, or its committee, and judged by them deserving of such distinction."

The Reid and Auld Prizes.

For the first, second, and third best models of "Anything new in the art of clock and watch making—by journeymen or master watch and clock makers." If these should be considered worthy of prizes, the year's interest of the Reid and Auld bequest, being about seven guineas, divided among them in such proportions as the Prize Committee shall fix, according to merit. To such as deserve it, the Society may add to the amount of the prize out of its general funds.

By the liberality of Charles Cowan, Esq., of Loganhouse, the president, and his partners, the Council are enabled to offer a prize of fifty sovereigns, with the Society's silver medal, for the best communication, if otherwise approved, on the "Purifying of Water which has been used in the manufacture of Paper."

The processes employed may shortly be stated to be:—

1. The washing of "filthy rags," and other fibrous materials, for which a large quantity of pure water is requisite.
2. The boiling of such materials in an alkaline solution, and the washing of the contents of the kiers or boilers in which the boiling operations have been conducted. And

3. The steeping of the half-stuff in chests in a solution of chloride of lime, and the washing of the partially exhausted bleaching agent from the half-stuff.

Intending competitors are requested to keep especially in view the circumstances in which the paper manufacture is carried on on the banks of the North Esk, in the county of Edinburgh. The merits of any suggestions which may be submitted will be regarded as being of greater value:—

1. By these being effected at moderate expense, and by their being applicable with as little interference as possible with the existing plant and mode of manufacture. And
2. By any substances, whether in suspension or solution, hitherto carried off in the stream, being demonstrated in practice, and by simple means to be capable of imparting fertility to arable or pasture land, or of being profitably applied otherwise.

Communications lodged in competition for prizes shall not have been patented, nor previously published, nor read before any other Society. Patented articles may, however, be exhibited and described.

For particulars as to the form in which communications should be sent, application should be made to John Beatson Bell, Esq., Secretary, 5, Hill-street, Edinburgh.

Manufactures.

Respiratory Apparatus.—Monsieur Galibert, of Paris, has invented an apparatus for affording a supply of atmospheric air to the lungs of persons working under water, or in places filled with noxious gases or smoke. The nose of the person is closed by a *pince-nez*, and a piece of horn or ivory, pierced with two holes, and shaped to some extent like the mouth, is inserted between the lips; adapted to each of these holes is a strong india rubber tube, capable of resisting pressure; these are fixed to the waist of the person, and then connected either with the outer air, if this can be arranged, or, if not, with an air-reservoir made of the entire skin of an animal, which may be carried on the back like a knapsack, and which contains a supply of air sufficient for a quarter or half an hour. The person using the apparatus should first apply the tongue to one hole and take a long inspiration, and then to the other hole during expiration. The apparatus, with air-reservoir, is intended to be employed by persons having occasion to remain some little time in wells, mines, drains, or in the midst of smoke. In some cases spectacles, specially calculated to protect the eyes, are added. When used under water, no air-reservoir is employed, but the tubes are made to communicate with the air. The inventor recommends its use for the purposes already referred to, as well as in cases where a total immersion of the body for some time in a bath is found desirable.

Great Lens.—A gigantic telescope is being made for the Imperial Observatory in Paris; and the great establishment of Saint Gobain has just completed for the new instrument a lens, of which the focal length is not given, but which is described as being seventy centimètres (28 inches) thick. It is six years since the lens was commenced, and it is said that the company presents it to the Observatory.

Commerce.

The Tea Duty.—Messrs. Capel and Co., in their circular, dated 8th May, say :—"We have had a fluctuating market since our last circular; the trade continued to buy freely at the improved rates quoted, until the morning of the 17th ult., when an announcement in the *Times*, that a further reduction in the tea duties would form a feature of the Budget, led to more extensive purchases at a further advance of ½d. to 1d. per lb. When it became known that not only was this the case, but that the reduction was to the extent of 6d. per lb., there was considerable excitement, and on the Friday and Saturday offers to a large extent were made at prices showing a further rise of 1d. to 1½d. per lb. The majority of holders, however, held out for still higher prices, and the business actually done was comparatively limited. Since then the excitement has subsided, and the prices now obtainable are only ½d. to 1d. per lb. above those of the 27th ult. The Government proposed that the reduction of duty should have taken place on the 6th instant, but the retail trade considered this a great hardship, owing to so short a notice after what they supposed to be a final settlement of the question in 1863; and, after great pressure, the Government have consented to postpone it until the 1st June. The postponement of the duty has also brought business to a partial stand, but when it comes fairly into operation we look to see a very large increase in consumption, as duty-paid tea will then be very cheap, and within the reach of a large portion of the population who have hitherto scarcely been consumers of the article."

Colonies.

Proposed Division of New Zealand.—In Auckland and Otago a movement for separation has sprung up. Auckland, shorn of its *prestige* as the capital city, and jealous of Wellington, demands to be constituted into a colony of itself, while Otago wishes to cut short the connection which exists between the northern and middle island. Auckland asks the Imperial Government to take the charge of native affairs, and pay the cost of doing so, while Otago wishes the north island in the future to bear alone the charges of the native war.

Wellington Census for 1865:—The total number of persons in the province, according to the present returns, appears to be 14,938, of whom 8,307 are males, and 6,631 females. In 1861 the total number was 12,566, thus showing an increase, during four years, of 2,372. The proportion between males and females is somewhat disturbed—the former being now more numerous. In 1861 the number of males was 6,626 against 5,940 females, while in 1865 the disproportion is greater. This in time may grow a serious evil, and demands a timely remedy in the shape of increased female immigration. The figures subjoined give some information as to the nationality of the population in the province. The English element is predominant, comprising one-third of the whole population; the Scotch rank next, but is much less prominent, being little more than one-tenth of the whole; while the Irish is still less. The remainder of the population are of New Zealand, Australian, Canadian, American, and European origin, those under the head of New Zealand figuring most largely in the returns. The advance in agricultural operations since 1861 has been very considerable; while in that year there were 55,313 acres under crop, the number now is 95,416 acres. The increase appears still more marked in going back farther still, the figures standing thus:—In 1855, 10,530 acres; in 1861, 55,313 acres, and in 1865, 95,416. The total number of acres fenced in is now 127,349. The increase in live stock has also been considerable. The present number of houses in the province is 2,900. The number of males in the province is 8,307; and of females, 6,631. The educational census shows that of those who cannot read (under 15 years of age) there are 3,173; above 15 years of age, 430; of those who can read (under 15 years of age), 1,064; above 15 years of age), 521; of those who can read and write (under 15 years of age, 2,258; above

15 years of age, 7,492. The number of acres under cultivation is 95,416.

New South Wales Finance.—At the opening of the Sydney Parliament, the Governor, referring to the finances of the state, said that during the year 1864 an additional deficit of £413,000 accrued, notwithstanding the many retrenchments made. The loss of crops from rust and inundations to the extent of at least half a million, and the loss of stock from disease and floods, by diminishing the purchasing power of the agriculturists, and other producers, very seriously cut down that portion of the revenue which is derived from customs' duties, while a great falling off in the sale of the waste lands of the Crown, deprived the Treasury of a large portion of the revenue ordinarily derivable from that source. He invited the members to look these financial difficulties in the face, and to aid the Government in providing the additional income, which was so urgently required to construct the public works, pay the debts, and maintain the credit of the colony.

Cotton and Sugar in Queensland.—A local journal says that the failure of cotton cultivation in this colony may be attributed mainly to the absence of experience in its cultivation, a fatal belief having got possession of the public mind at the very outset that cotton would grow there without care or trouble. The contrary has been found to be the case, and it is now becoming a pretty general belief that no branch of cultivation requires more care or experience. The hopes of the colony as a cotton producer are now confined to the plantations of private individuals, most of the cotton companies having given it up. While, however, cotton, on the whole, has disappointed the planters, sugar cultivation has progressed in favour wherever tried during the last three years. Many agriculturists have planted quantities of cane during the past three or four seasons as an experiment, and the effect of severe droughts succeeded by floods for the last two years has convinced them that sugar cane is a certain crop and one offering every possible inducement for its cultivation. The fact has been well known that sugar-cane has thrived well in this colony during the last 15 years, but the absence of practical sugar manufacturers prevented any extent of cultivation until Captain Hope's enterprise in cane cultivation and the erection of sugar machinery at Cleveland, Moreton Bay, aroused public attention to the great value of its cultivation. The arrival in Queensland of a number of gentlemen from the West Indies, Mauritius, and other places, with a view of settling and investing their capital, has given confidence to capitalists desirous of investing in sugar plantations as a safe investment for colonial capital. Already upwards of 6,000 acres of land have been granted, under the Queensland sugar regulations, to gentlemen of high standing in this and other colonies.

Notes.

District Telegraph in Paris.—This service was established in January, 1864, and the cost of a minimum message was fixed at one franc. The number of messages was thus:—January, 577; February, 630; March, 745; April, 803; May, 808; June, 762; July, 784. On the 15th of August the cost of a message was reduced to half-a-franc, and the number of messages sent was as follows:—August, 2,500; September, 3,434; October, 6,849; November, 8,120.

Preservation of Ice in Small Quantities.—The importance of being able to keep small quantities of ice for various purposes, and especially in sick rooms for medical use, cannot be overrated. Dr. Schwarz has communicated the following simple method, which he has practised with success. He says, put the ice in a deep dish or jug, cover it with a plate, and place the vessel on a pillow stuffed with feathers, and cover the top with another pillow carefully, by this means excluding the external air. Feathers are well-known bad conductors of heat, and in consequence the ice is preserved from melting. Dr. Schwarz states that he has thus preserved six pounds of ice for eight days. The plan is simple, and within the reach of every household.

French Academy of Moral and Political Science.—Dr. Milman, Dean of Saint Paul's, has been elected a corresponding member in the historical section of this branch of the Institut of France, in place of M. De Raumer, recently raised to the rank of Foreign Associate.

City Horticulture.—There will be an exhibition of floral decoration of balconies and windows, at the Royal Horticultural Gardens, on Her Majesty's birthday, May 24. Also, on the first Monday in August, will be awarded prizes for the best plants and vegetables cultivated by soldiers in barracks, by sailors in homes, by coast-guard men, and by workmen employed in her Majesty's dockyards. Also at a public fête, on the first Monday in September, will be awarded prizes for specimens of window-gardening among the working classes in metropolitan parishes.

Royal Horticultural Society.—The last scientific meeting was held on May 2nd, when the Rev. M. J. Berkeley spoke on certain species of clematis, &c., and Mr. Bateman on orchids and vaccineœ.

Suburban Museums.—On Saturday, the 6th inst., a meeting of gentlemen interested in the proposed establishment of metropolitan district museums of science and art was held at the South Kensington Museum. The meeting was convened by invitation of the Committee of Council on Education. Earl Granville presided, and among those present were Lord Ebury, Mr. Henry Cole, C.B., Secretary of the Science and Art Department, Lord H. Lennox, M.P., Mr. Ayrton, M.P., Mr. Beresford Hope, M.P., the Hon. Mr. Cowper, M.P., Mr. Locke, M.P., Mr. Bruce, M.P., Sir T. F. Buxton, M.P., Mr. Briscoe, M.P., Mr. Powell, M.P., Mr. Alderman Salomons, M.P., Mr. Tite, M.P., Mr. Harvey Lewis, M.P., &c. Earl Granville said the meeting had been called together merely for the purdose of discussing what should be done with the present iron building. When it was proposed to get rid of it a suggestion was made that, instead of selling it as old materials, it might be more usefully disposed of by presenting it, at a nominal price, to the different districts of the metropolis so as to form temporary local museums. He had very little doubt but that, when once these were established, the people of the several districts would soon make efforts to procure handsome buildings of their own. Considerable discussion took place, the opinion being expressed that district museums, particularly if kept open in the evening would be of great value to the working classes. It was, explained that the Government proposed to accommodate three districts by dividing the building into three parts, a plan which received the approval of Mr. Tite, M.P., and others. A vote of thanks having been passed to Lord Granville, his lordship, in acknowledging the compliment, said the Science and Art Department were not by any means desirous of establishing a monopoly at South Kensington, but were most anxious to see district museums supported wherever they would be useful and agreeable to the inhabitants.

Education and Crime.—The large number of convicts at Toulon offers a good opportunity of noting the relation between cultivation and good conduct. It appears that there are at present 2,218 prisoners in the Bagne of Toulon, of whom 1,330 can neither write nor read; 649 can barely do either; 208 read and write imperfectly; and only 31 possess superior education.

Correspondence.

Testing and Welding Boilers.—Sir,—In the very able paper of Mr. Paget, on steam boilers, he alludes to the various modes of testing their strength. With regard to the disadvantage of a pulsating action, I think there can

be no doubt, whether arising from the alternating action of the cylinders or from the strokes of a ram. The simple mode in the latter case to moderate the evil would be to use a ram with three strokes nearly neutralising each other; and the water should as nearly as possible be in the condition of heat induced by steam. If cold water be used approaching to frost, the metal will be rendered brittle and the joints leaky. With moderately-heated water the metal will be tougher and the joints tighter. As regards the general structure of boilers, it is radically vicious, and will continue to be so just as long as the principle of rivetting continues in use. No truth can be clearer than that the metal should be all of one equal thickness, at least where in contact with fire, and that thickness must not exceed the free action of heat in passing through it. If it be too thick, the metal will simply burn away till reduced to the right thickness, in those parts exposed to the fire, and thus the thickness will vary and the strains will be unequal. These conditions will limit the pressure that can be safely put on the boiler. In the application of heat to raise steam there can be no doubt that flame is the best method. We all know how rapidly a sheet of paper will boil water in a tea kettle, and therefore it is that, whenever we can get petroleum cheap enough and use it rightly it will be the best fuel, as it may be made to cover a larger surface with direct heat. But to do it perfectly we must have all the heating surface of equal thickness, a condition which cannot be attained till we get rid of the folded surfaces essential to rivetting. There is no apparent difficulty in welding all the seams of a boiler, whether of copper, iron, or steel. Welding is simply a condition of rendering the clean metal surfaces pasty, by heat, and then inducing perfect contact by pressure, uniting thoroughly the softened portions. That can only be done by the flame heat covering all portions of the surfaces to be united, without any uncombined oxygen getting access to them, for if it does, scaling will ensue; and when scale occurs the effect will be like that of dry flour between bakers' rolls—contact without union. Nor will either percussion or pressure drive out this scale, but on the contrary will drive it in. Now suppose two clean edges of a piece of welding metal to be placed an eighth or quarter of an inch apart from each other, and that they are held in position by a box of fire-clay, fitting close to all parts except those intended for union, with entrances and exits, or "gates," as technically termed by the founders, allowing a free passage of air through the joint; if then carburetted hydrogen gas and atmospheric air, mixed in the right proportions for combustion, in a chamber under pressure, be forced through the joint, burning, the exposed surfaces of the joint will be made pasty or partially melted; and if pressure, hydraulic or other, be brought to bear to force them into contact, there will be homogeneous union without scale, because there will be no free oxygen to cause the scale, as in the ordinary mode, by irregular jets, and blows of a hammer; and there is no apparent reason why boilers, or any other weldings, should not be produced in the same manner, for the flow of the burning gas may be continued without intermission for any required time. My conviction is that this method will prove to be the true one for producing boilers without seams and rivets and of equalised thickness.—I am, &c.,

W. Bridges Adams.

The Wear and Tear of Steam Boilers.—Sir,—Having read Mr. F. A. Paget's able and useful paper on "The Wear and Tear of Steam Boilers," published in your number for April 28th last, and in particular his account of the furrowing and pitting of boiler plates, I am glad to see that he gives what, in my opinion, are the true causes of these forms of destructive action. My object in now addressing you is to state that, in 1860, I published, at some length, my observations on this subject, in my work on the "Recent Practice in the Locomotive Engine," where I advanced precisely the same views of the causes of furrowing and pitting as those now advocated by Mr. Paget; and, so far as I am aware, this was the earliest publication of the true causes. If I am in error, I shall be glad to be set right. Meantime, if you will allow me, I will shortly quote from "Recent Practice" my conclusions on the furrowing and pitting of boiler plates:—

"Probably the most important practical inference to be drawn from the tests of the strength of rivetted joints, is the explanation they supply of the failure, hitherto unexplained, of boiler plates, not at the joints, but in their neighbourhood. We are aware that electrical and galvanic action are freely adduced in explanation. But these words have two meanings:—they mean electricity and galvanism; and they mean ignorance and mystery. It is known that boilers fail by corrosive and other agencies eating into the plates on the inside, pitting and furrowing the surface. The pitting of the metal is readily explained by the presence of chemical agents in solution in the water, and the known inequality of substance of iron plates and bars, in consequence of which the metal is gradually but unequally separated and dissolved; and probably a weak galvanic circuit may be established between the iron shell and the brass tubes, accelerating the process of dissolution. But this explanation does not meet the frequent case of a straight continuous furrow, cut like a groove, upon the surface. Furrows are observed to be formed parallel to, and close to, the rivetted joints. Not in any case, that we are aware of, have they been found at any notable distance from a rivetted joint, nor otherwise than parallel to one. The inference is inevitable, that there is a relationship betwixt them; and our conviction is, that the alternate tension and relaxation of the plates at the joints, as the steam is got up and let down, are attended by an alternate distortion, incipient it may be, and resumption of the normal form, a bending and unbending of the plate on each side of the joint; in consequence of which the texture of the metal is gradually loosened in lines near to, and parallel to, the joint, and it is thus laid open to corrosive action. On this interpretation, the commencement of a grove or furrow, establishing a weak place, and concentrating the action there, would suffice to extend and deepen it to the dangerous limits occasionally announced by explosion. The weakness attendant on lap joints is strikingly exemplified in the lap welded joint when subjected to extreme tension: the tensile strength, though the metal at the weld is perfectly solid and fully as strong in itself as the body of the plate, is much below that due to the regular section of the plate. Here there is no elementary weakness in the reduction of metal by rivet-holes; the inferiority of strength arises solely from the bending of the plates on both sides of the lap, and the overstraining of the fire-box, in the endeavour to attain to the position of stability. . . . . . The furrowing of lap-jointed plates reads an important lesson on the real and intimately practical value of direct connection and direct action in exerting, transmitting, or resisting forces. That the furrowing of plates at the rivetted joints results from the indirectness of the strain of the steam pressure, is rendered still more probable by the analogous furrowing which results from reciprocating strains of another kind. In the more ancient classes of engines, in which the cylinders are fixed to, and work from, the smoke-box plates, the alternate forward and backward strains by the steam-pressure on the piston have been observed to weaken, and to subject to corrosion and leakage, the substance of the plate along the edge of the angle-iron at the junction with the barrel. In further corroboration of this doctrine, Mr. Colburn states that he is not aware that any accidents from furrowing of boiler plates have taken place in the United States; and we believe that their immunity from accidents arising from this source is to be ascribed to the use of very thin boiler plates, quarter to five-sixteenths of an inch thick." (Pages 15 and 16.)

In addition, my explanation of the destructive action of unequal expansion of the fire-box of locomotives and the shell, upon the stay bolts, in straining them laterally beyond the limits of elasticity, and thus permanently weakening them, was published at the same time ["Recent Practice," p. 16 and 17], and, I think, anticipates all that Mr. Paget has just written on the same subject. I trust you can afford space for this letter, for in a paper like Mr. Paget's, elaborately based upon published authorities, it is of some importance, I think, that references, inadvertently incomplete, should be supplemented.—I am, &c., D. K. Clark.

11, Adam-street, Adelphi, May 9th, 1865.

ON COLONIZATION; ITS ASPECTS AND RESULTS.—SIR,— The late hour to which the discussion was protracted on the evening of the 3rd inst., precluded my replying to one or two remarks of the speakers, and compel me reluctantly to still further trespass on your space. The Chairman inclined to think that I consider that mechanical contrivances tend to cheapen wages, whereas the contrary will be evident by reference to page 407, at the foot of the first and head of the second columns, where I give the rationale, as I conceive, of the increase in wages caused by machinery. Professor Levi drew attention to the fact of so many persons emigrating to the United States in one year as contrasted with Canada. Two circumstances should be borne in mind in reference to this matter. Of the large number of fifty thousand emigrants, thirty-three thousand were Irish, the poorest class of emigrants; by the wealthier English, Australia, which is four times as expensive to reach, was preferred; and of the shrewd Scotch, while only 1,000 went to the States, 2,500 went to Canada, and upwards of 8,000 to Australia. We must, therefore, take into account the cheapness of getting to America, and the fact that the United States can scarcely be regarded as widely differing from our own country in laws and habits, before we come to the conclusion that the nature of the Government has nothing to do with emigration. Almost as much money was sent from America as would pay the passage of all the emigrants. With reference to Mr. Torrens's remarks, I may observe that the English army is composed of some 150,000 men, of which 50,000 are kept in England, and 100,000 are distributed throughout our colonies and dependencies. To the effect, therefore, of what bone and muscle may be necessary to maintain 100,000 efficient men abroad, the home country is exhausted; and as each man costs about £30 a-year, the money abstracted from the country on this account amounts to £3,000,000 annually. With respect to the colonies being represented in the Home Parliament, I confess I once held the opinion of its desirableness, but when I find how little even the important subject of India can be made to interest the English Parliament, I must say I tremble for the attention which would, under the proposed plan, be given to the hon. Member for Vancouver's Island or Labuan. With reference to cotton, I have only to observe that if, in the hour of our need, we have drawn two-fifths of our supply from our own dependencies, that is a large proportion. Whether India can grow cotton to compete with America I am unable to say. It appears to me to be a question of climate, soil, seed, and treatment, and I should prefer seeing a peaceful rivalry to any other condition of matters. I may add that it is not the South who have prevented us having cotton, but the North; and I believe I only echo the statement of every Englishman (from the Premier downwards) in severely reprobating the conduct of Butler. Mr. Hill somewhat hastily concluded that my views on transportation are theories. Twice I visited New South Wales in its convict days; twice I resided for some time in Van Dieman's Land; and it so chanced that I lived for two years with the only unofficial family who ever remained on Norfolk Island for any period while in its worst days. My opinions are based on personal observation. I have known expirés and ticket men, in both New South Wales and Van Dieman's Land, whose cheques would be honoured for thousands, whose acceptances would be discounted by the most scrupulous bank, who properly attended to all the duties of life, educating their children, serving on juries side by side with freemen as fellow citizens, regularly attending divine service, &c. Now what do I see at home? Garotters, burglars of the most serious character; and almost every daily paper contains accounts of trials in which the worst class of prisoners are stated to have previous convictions recorded against them. I cannot speak as to Ireland. I am only too happy to hear that Ireland is satisfied with her convicts; England certainly is not. Mr. Hill did not explain how he would act upon Bacon's dictum, and prevent men "multiplying their depravity." It rather seems to me that the difference between us is mainly this—Mr. Hill would allow the race to propagate surrounded by their old vicious companions, and without room to grow out into purity; whereas I would allow them space and opportunity to return to obedience to the laws of nature and man. I am rather surprised that Mr. Hill should detect any similarity between the rock-bound, harbourless Norfolk Island, containing some fourteen square miles, with its masses of closely-huddled male convicts, and the Falkland Islands, containing some 7,000 square miles, with harbours and ports, where I proposed to disperse the convicts on small farms.—I am, &c., W. STONES.

MEETINGS FOR THE ENSUING WEEK.

MON. ...British Architects, 8.
Asiatic, 8.
Royal United Service Inst., 8½. Major C. H. Owen, R.A., "The Present State of the Artillery Question."

TUES. ...Society of Arts, 8. Cantor Lectures. Dr. F. Crace Calvert, "On some of the Most Important Chemical Discoveries made within the last two years." (Lecture VI.)
Civil Engineers, 8. Mr. Edward Fletcher, "On the Maintenance of Railway Rolling Stock."
Statistical, 8. Prof. W. S. Jevons, M.A., "On the Variation of Prices and the Value of the Currency since 1782."
Pathological, 8.
Anthropological, 8. The Bishop of Natal, "Missionary Work in Africa."
Royal Inst., 4. Prof. Frankland, "On Organic Chemistry."
R. Horticultural, 3. Scientific Meeting.

WED. ...Society of Arts, 8. Mr. Zerah Colburn, "On the Manufacture of Encaustic Tiles and Ceramic Ornamentation by Machinery."
Pharmaceutical, 11. Annual Meeting.
R. Society of Literature, 4½.

THURS...Royal, 8½.
Antiquaries, 8.
Chemical, 8.
Numismatic, 7.
Philosophical Club, 6.
Royal Inst., 4. Prof. Frankland, F.R.S., "On Organic Chemistry."

FRI.......Philological, 8. Annual Meeting.
Royal Inst., 8. Mr. Wm. Huggins, "On Stellar Physics and Chemistry."

SAT.......Royal Inst., 4. Mr. Alexander S. Herschel, "On Meteorology."

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered during the Easter Recess.*

64. Bills—Theatres, &c.
105. ,, Sewage Utilization (as amended by the Select Committee).
100. ,, Land Drainage Supplemental.
106. ,, Lancaster Court of Chancery.
109. ,, Police Superannuation.
111. ,, Private Bill Costs (Lords Amendments).
101. ,, Roads and Bridges (Scotland).
93. ,, Grand Juries (Ireland).
107. ,, Oxford University (Vinerian Foundation).
3 (300). Railway and Canal, &c., Bills—Board of Trade Reports Part 300.
65 (VI). Committee of Selection—Seventh Report.
47. East Indian (Bootan)—Papers.
140. Mines—Return (Corrected Copy).
145. Tithe Commutation—Return.
79. East India (Gold Currency)—Resolution.
137. Works and Public Buildings—Abstract Account.
179. Rochdale and other Waterworks Reservoirs—Reports.
182. War Office (Superannuations)—Return.
194. Immigrants and Liberated Africans—Return.
198. Railways (Session 1865)—Board of Trade Report.
193. Salmon Fisheries (England and Wales)—Fourth Annual Report of Inspectors.
158. Criminal Offenders (Scotland)—Abstract of Tables.
161. Increase and Diminution (Public Offices)—Abstract of Accounts.
163. Church Building Acts, &c.—Return.
170. West Coast of Africa—Report.
187. Army Chaplains, &c.—Detailed accounts.
197. Chelsea Bridge—Return.
151. Agricultural Parishes—Return.
199. Telegraphic Communication (India, &c.)—Correspondence and Papers.
82. Steam Transports (England and India)—Specifications.
110 (I). Revenue Expenditure, &c.—Returns.

159. Steam Transports (England and India)—Reports and Correspondence.
178. Open Spaces (Metropolis)—First Report, &c., of the Select Committee.
191. Benefices (Metropolis)—Returns.
90 (III). Civil Service Estimates (Class III).
192. Public Offices (Site and approaches)—Plan.
173. Patent Office—Return.
91. Revenue Departments - Estimate.
92. Post Office Packet Service—Estimate.
174. Cawood Charities—Report.
175. Bakehouse Regulation Act Reports.
183. Post office Savings Banks—National Debt.
190. St. James Garlichithe, &c., Rectories—Minutes, &c.

By Command—Church Estates Commissioners—Fourteenth Report, &c.
,, Ecclesiastical Commissioners for England—Seventeenth Report. &c.
,, Foreign Statistics—Statistical Tables, Part IX.
,, Convention of Geneva—Accession of the British Government.
,, Sewage of Towns, &c.—Third Report of Commission.
,, New Zealand—Further Papers.

Delivered on 25th April, 1865.

169. Isle of Man Disafforesting Act—Copies of Papers and Documents.

Delivered on 26th April, 1865.

108. Bill—Local Government Supplemental (No. 2).
153. Customs Out-Door Officers—Memorials.
188. Recorder of Galway—Papers.
201. Coast Guard Service—Detailed Accounts.
204. War Office (Temporary Clerks)—Return.

Delivered on 27th April, 1865.

112. Bill—Waterworks.
90 (I). Civil Service Estimates (Class I.).
162. Superannuations (Public Officers) Account.
208. Register of Sasines (Edinburgh)—Returns.

Delivered on 28th April, 1865.

114. Bills—Railways Clauses.
116. ,, Locomotives on Roads (as amended in Committee).
118. ,, Local Government Supplemental (No. 3).
196. East India (Dhar)—Further Correspondence.
210. Land Registry—Returns.
219. Army—Statement.

Patents.

From Commissioners of Patents Journal, May 5th.

GRANTS OF PROVISIONAL PROTECTION.

Abdominal and scrotal bandage—1016—A. Stewart.
Boilers, apparatus for feeding—1062—R. A. Brooman.
Boots and shoes, elastic binders for—1050—W. E. Newton.
Boots and shoes, flexible spring waist for—1034—B. W. L. Nicoll.
Buildings, apparatus for making communications from one part to another—1143—J. J. Parkes.
Cigar cutter—1139—H. C. Butcher.
Corn, &c., screening, sifting or riddling—1105—W. Beaven.
Cues, rests or supports for—1048—G. Jackson.
Dress, fastening for articles of—1165—C. W. Heaven.
Distilling hydrocarbons, apparatus for—1076—J. Dougan.
Electricity, communicating intelligence by means of—1088—R. A. Jones and J. Hedges.
Engines, locomotive—48—C. de Bergue.
Fabrics, securing buttons to—1151—G. Davies.
Felts, &c., apparatus for printing—1155—J. Wilkinson, jun.
Fibres, threads, &c., preparing—1169—R. A. Brooman.
Fibrous materials, machinery for combing, &c.—1084—T. Whitehead and N. Nussey.
Fibrous substances, preparing and spinning—1125—E. Lord.
Fire-places and flues—989—E. Welch.
Fire-arms—1046—T. J. Mayall.
Fire-arms, breech-loading—1071—A. Henry.
Fire-arms, breech-loading—1092—G. T. Bousfield.
Glass, protecting designs on—1111—D. S. Buchanan.
Hoop iron, manufacture of—4063—T. Bennett.
Human hair, machinery for cutting—973—R. Maynard.
India rubber, substitute for—1068—W. Clark.
Iron, bar used in puddling—968—G. W. Dyson.
Iron, manufacture of—1153—J. N. Brown and T. D. Clare.
Iron safes and strong rooms—1056—J. Chubb.
Lace or net fabric, articles of—1129—C. J. and J. A. Keenan.
Ladies' skirts—1080—J. C. A. Henderson.
Land, ploughing and tilling—1123—C. Hall.
Liquids, pouring and decanting—1149—N. Sibly.
Locomotive engines, &c., construction of—916—G. R. Stephenson and G. H. Phipps.
Locomotives, compensating wheel to be used with—1022—J. J. Myers.
Looms—1032—A. Turner.
Looms—1070—M. Smith.
Looms—1086—J. E. H. Andrew.
Madder, treatment of—538—P. A. Le Comte de Fontaine-Moreau.
Matches, receptacles for—1121—G., G. W., and J. Betjemann.
Metallic rods, tapering the ends of—976—E. H. Newby.
Metal plates, machine for straightening, bending, &c.—1082—J. Todd.
Navigable balloons—930—P. Haenlein.
Oiling cans—1119—G. Whillock.
Ores, &c., furnaces for smelting—942—H. Brook, J. Eastwood, and G. Brook, jun.
Penholders—1147—W. E. Newton.
Photographic cameras—1171—J. A. Rowland.
Power engine—1052—H. Leonhardt.
Pulley blocks, iron sheaves and bushes for—1085—J. Gardner, R. Lee, G. H. Wain, and S., C., and S. Hargrove.
Pumps—1099—M. Houssepian.
Railways, permanent way of—1131—W. Bunger.
Railway trains, communication between the passengers and guard of—1078—G. W. Garrood.
Railway trains, communication between the passengers and guard of—1097—D. Hancock and T. Evans.
Railway trucks, &c., means of covering—1090—W. Riddell.
Rotating brushes—1038—J. Haworth.
Ships of war, &c., construction of—1107—H. Caudwell.
Ships, steering—1157—W. Elder.
Solutions, apparatus employed in the concentration of—872—W. Walsh.
Spindles, &c., apparatus for lubricating—1060—J. Rippon.
Spinning, spools or bobbins to be used for—1127—J. H. Wilson.
Steam boilers, safety apparatus for—1066—J. M. Courtauld.
Suction and blast, method of applying—1028—R. A. Brooman.
Superphosphates of lime, manufacture of soluble and assimilable—1161—W. Clark.
Swimming, shoe for facilitating the art of—1145—A. Atkins.
Taps or stop cocks—1101—W. Clark.
Tubes, fitting of surface condenser—1133—A. V. Newton.
Umbrella and parasol tip fasteners—833—R. Lublinski.
Water and gas, pipes for conveying—1058—C. F. Cotterill.
Waterproof fabrics, manufacture of—1159—J. C. Wickham and A. E. Deiss.
Wet gas meters—1072—T. Newbigging and A. Hindle.
Wheels—1024—S. Wright.
Wood, taking impressions from the grain of—1117—W. Scarratt and W. Dean.
Wool, treatment of—1042—H. Sikes and G. Jarmain.
Wringing machines—922—H. Lewis.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Pumps—1210—C. E. Herpst.
Silks, &c., apparatus for spinning—1202—P. A. Le Comte de Fontainemoreau.

PATENTS SEALED.

2716. W. Davies and G. and W. Cate.
2770. C. Garton.
2771. W. K. Hall.
2780. S. Dixon.
2788. J. A. Manning.
2790. R. B. Cooley.
2794. J. McCall & B. G. Sloper.
2795. T. L. and R. Boote.
2803. W. Clark.
2815. J. Thorne.
2817. J. Keats and W. S. Clark.
2857. R. Holiday.
2859. R. Allinson and H. Lea.

From Commissioners of Patents Journal, May 9th.

PATENTS SEALED.

2807. J. Kinniburgh.
2811. W. C. Thurgar and R. A. Ward.
2816. H. and E. Sutherland.
2821. F. A. Papps.
2828. T. Jones.
2832. G. E. Noone.
2836. R. Harlow and W. Jolley.
2842. M. Henry.
2848. P. Lachèz.
2850. J. Bullough.
2852. A. Wall.
2858. M. Destrem.
2884. M. Henry.
2891. J. Phillips.
2902. W. Martin.
2946. W. Ward.
3026. W. Clark.
3056. H. Wilson.
3081. W. B. Adams.
3096. H. Taylor.
93. A. G. Lock.
491. I. Pariente.
753. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1345. A. Morel.
1364. N. Wood and J. Stockley.
1307. H. Juhel.
1321. J. and T. Mellodew, and C. W. Kesselmeyer.
1342. B. Cooke.
1360. P. H. Colomb.
1328. H. Allman.
1337. J. Roscoe.
1340. J. H. Johnson.
1376. W. Riddle.
1347. P. Chenaillier.
1358. E. Bourdon.
1389. L. D'Aubreville.
1343. T. Cabourg.
1362. T. H. Hopwood.
1369. G. T. Bousfield.
1378. W. Southwood.
1381. C. Lungley.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

985. J. Taylor.
992. W. E. Newton.
999. W. S. Hollands.
1111. J. Brown.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, MAY 19, 1865. [No. 652. VOL. XIII.

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Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

MAY 24.—"On Anchors and Cables; their History, Varieties, and Properties." By THOMAS M. GLADSTONE, Esq., C.E.

MAY 31.—*Derby Day.* No MEETING.

JUNE 7.—*Extra Meeting.*—"On the Policy of an Amalgamation of the Railways of the United Kingdom, under Government Management." By WILLIAM HAWES, Esq., Chairman of the Council.

Conversazione.

The Council have arranged for a Conversazione on Wednesday, the 14th June, at the South Kensington Museum, cards for which will shortly be issued.

International Exhibition of 1862.—Jury Reports.

The Council beg leave to announce that there are a small number of copies remaining of these Reports, which may now be had on application at the Society's House, price £1 5s. in cloth, or £1 11s. 6d. bound in morocco.

Proceedings of the Society.

Twenty-third Ordinary Meeting.

Wednesday, May 17th, 1865; M. Digby Wyatt, Esq., in the chair.

The following candidates were proposed for election as members of the Society:—

Roper-Curzon, Hon. Sidney, Grove House, Lower Tooting, S.
Scarell, Thomas, Beddgelert, Carnarvonshire.

The Paper read was—

THE MANUFACTURE OF ENCAUSTIC TILES AND CERAMIC ORNAMENTATION BY MACHINERY.

By ZERAH COLBURN, Esq., Memb. Inst. C.E.

Wherever the feet of primeval man fell often, whether in his dwelling, on the highway, such as it might have been, in the places of traffic, or in the rude temples of the earliest religion, he must have soon learned the necessity for paving. Once accustomed to pave, experience would soon teach him to choose the harder stones and well-baked earths for the protection of his frequent paths, as well as for the preservation of the threshold and the hearth of his own home. In these uses of well-beaten and sun-dried clay, fictile art had its birth. The roughly-moulded forms employed for fire-places were soon found to harden with the heat; and, even before the vast brick-fields of Babel were worked, men might have said, "Let us make brick and burn them thoroughly." As a factitious stone the Romans made their bricks in the form of flags. At Toulouse the old Roman bricks are 14 inches long, 9 inches wide, and only 1¼ inch thick, corresponding to our own notions of tiles—the word "tile" being believed to be from the Latin root of *tego*, to cover. Ages, however, before the conquest of Gaul, bricks of nearly the same proportions had been used for paving; and flooring, in brick and stone, at first roughly practised in obedience to necessity, at last became an art. The Greeks, with their fine taste for the beautiful in form and colour, appear to have been among the first to employ mosaic paving; and their own and Roman *tesseræ* of marbles and porphyritic stones—the colour sometimes altered by burning —still survive in nearly their original splendour. These were not confined merely to tesselated arrangements, nor to kaleidoscopic combinations of geometrical forms, but they often took a pictorial character, as in the Roman pavement at Cirencester; and modern artists have shown how indestructible mosaics of this class, made not of abaciscus, but of clay cubes, or dados, smaller than dice, may almost rival tapestries in their richness and blending of colour. The pavement at Cirencester, the ancient Corinium, has, indeed, been adjudged by some of the first authorities in art to be a work of superior artistic merit. Its thirteen medallions, within as many compartments of guilloche bordering and decoration, are remarkable for the truth and precision of their figures, and they might almost be mistaken for paintings. In the late International Exhibition a mosaic pavement, by Messrs. Maw and Co., had upwards of eighty thousand *tesseræ*, mostly in quarter-inch cubes; and its five

medallions, from 1ft. 9in. to 2ft. 6in. in diameter, contained each a human head, almost living in its expression, and in which the flesh tints were graduated with remarkable accuracy, nearly rivalling the finish of portrait painting in oil. Messrs. Minton, Hollins and Co.'s mosaic pavements, exhibited on the same occasion, contained one hundred and fifty thousand cubes, of which eight thousand were included in a single classical head or medallion in the centre, and only ten inches in diameter. Although the ancients literally paved the way in the art of mosaic decoration in stone and terra cotta, we have already learned to excel the finest remains of this art in respect of elaborate design, and beauty, and careful graduation of colour; and more especially in mosaics formed wholly of natural stones, we possess a variety of materials, and an amount of skill in grouping and working them, sufficient to raise some of our productions to the level of the best examples of Florentine art. We can now command every variety of marble, whether monochromatic, variegated, or brecciated; and some of the recent mosaic pavements in the restored sacraria of certain of our cathedrals attest the value of the acquisition, to this branch of art, of the beautiful verde marbles from Connemara, near Galway. To the marbles we can bring serpentine from Mona and the Lizard, fluor spar from Derbyshire, red granite, steatite, lithographic stone, and even alabaster, aventurine, and malachite.

But mosaic decoration in natural stones must, if effective, always be costly. A recent beautiful stone mosaic, ten feet square, in the sacrarium of Chichester Cathedral, cost £200, or £2 per square foot. And it is plain that mosaics in terra cotta, where elaborate arabesques and radiating or interwining foliations are introduced—to say nothing of medallions—must be expensive also. Hence, at an early period, square tiles, curiously and richly ornamented, were employed for pavements and for walls. The decoration of the Alhambra, and of other works of the Moors while in Spain, largely consists of square tiles stamped with intricate and beautiful patterns. Many examples of this fine old Azulejo work, with the ornamental figures burnt in, or *encaustic*, in various coloured clays, are still to be found in very early structures; and in mediæval times encaustic tiles became comparatively common in church decoration. Instead of enamel, the encaustic tiles had their pattern impressed deeply into their upper or outer face, and the impression filled with one or more clays, which burnt to a different colour or colours from the body, thus leaving the pattern inlaid in the desired colour. Of course almost every tint and shade could be produced, both in the body and in the pattern, the clays in their natural state alone, without the mixture of pigments, giving a considerable range of colour. The manufacture was exceedingly simple, yet, whether from neglect, or from a change in popular taste, it had in later times become extinct; and in the beginning of the present century it might have been classed with the lost arts. There was enough, however, in the old encaustics themselves to show how they must have been made, at least, when they were carefully examined with the aid of moderate reflection and a little reasoning.

It was evident that encaustic tiles, while they admitted of a style of decoration not to be obtained in mosaic, could also be more cheaply produced, at least if the mosaic were in any considerable degree intricate; for to obtain an elaborate and varied pattern by mere tesselation, the *tesseræ* must be very small—the smaller the better, until they approach in size the scarcely distinguishable squares in needle-work patterns in coloured wools. But, as each little cube has thus to be separately made and coloured—there being, perhaps, five hundred or a thousand of these in a space only six inches square—their manufacture would necessarily be slow, and therefore costly. In encaustic, on the contrary, the square of six inches—called a quarry, from the French *carré*—would be formed in a single piece; and, the impressing stamp once made, no matter how intricate the design, hundreds or thousands of these quarries could be stamped successively, and filled in with the contrasting colour, with comparatively little labour. Ornamental tiles, it is true, are also cheaply made in majolica ware; but, however pleasing may be the forms pictured upon them, the surface of majolica is not so suitable, nor so satisfactory to the eye, as that of an unglazed tile, in its honesty of hardened clay and the genuine ingrain of its colouring.

It was in the year 1830 that the late Mr. Samuel Wright, then of Shelton, North Staffordshire, revived the manufacture of encaustic tiles, by specifying, under his patent of that date, his mode of making them. He employed a mould within an iron frame, and with a removable top and bottom, the inner surfaces of the mould being of plaster of Paris, which does not adhere to plastic clay. Once set, plaster of Paris is very hard, and hence Mr. Wright found no difficulty in forming in it the most intricately wrought designs, in alto relievo, for impressing the upper or outer surface of the tile.

It is now time to describe the manufacture of encaustic tiles as patented by Mr. Wright, from whom Messrs. Minton and Co. obtained a license, extended, by a prolongation of the patent by the Privy Council, to 1851. There are, no doubt, some gentlemen here who accompanied the Archæological Association to Shrewsbury in 1860, and who then partook of the elegant hospitality of Mr. Maw, at Benthall-hall, near Broseley, and who there listened to a very succinct and interesting account, from that gentleman, of the whole process of encaustic tile-making. While referring to that account, the author gives the following, almost identical with it, but derived from his own observations in the potteries.

The stronger and purer clays and marls, from the coal measures, as also other clays brought from the South of England, burn, without the mixture of colouring matter, into red, buff, and fawn-coloured tiles; and, with the addition of different proportions of oxides of iron and manganese, they burn into the black, chocolate, and grey tiles. The higher qualities of tiles, such as the white and those of richer colour, are made from a kind of porcelain clay, or Parian, the white being left uncoloured, while the blues and greens are coloured with oxides of chrome and cobalt. Where the clay is too strong or adhesive, from a deficiency of silica, a greater or less proportion of sand is added for the coarser tiles; but for the finer qualities, the proper proportions of silica and alumina should exist in natural combination in the clay itself. The clay is all the better if "weathered" by exposure, in thin layers, to sunshine or to frost, the effect of both of which is to break it up into fine particles, and to secure increased waxiness, if the term is permissible, in working. The clays are then, and in mixture with whatever colouring matters are employed, reduced to a state which not only potters, but many others besides, know as "slop," that is, they are mixed with water until the mixture becomes sloppy, and in this state they are strained through a sieve of fine lawn; the finer the better, and the fineness often amounts to fifteen thousand meshes or perforations in the square inch. This process of sub-division, resembling filtration, although only the coarser matters are retained by the lawn, gives great fineness and evenness to the texture of the clay, while it adds also to the brilliancy of the colour. Thus strained, the viscous clay is then dried to a plastic state, upon what are called the slip kilns. It is as well to say at once that, even for plain tiles, or those of but a single colour, two qualities of clay are taken, one for the body of the tile, the other and finer sort for the upper, or perhaps, both the upper and the lower surfaces. As in much modern furniture, so in tiles, where the visible grain and colour are but superficial, the coating of the finer material is called veneering. The workman first fills the bottom of his plaster-mould with a thin layer of the finer or veneering clay, and then beats upon it the coarser or body clay, of which nearly seven-eighths of the whole thickness of the tile is formed.

Upon the body clay he places a further coating of veneering, and upon this he closes the mould. The bottom of the plaster-mould has raised upon it, in alto-relievo, the design for the impressed pattern, and on reversing and separating the parts of the mould, and removing the tile, it is left standing with its impressed design on its upper face. In its still plastic state, the impression upon the tile is filled with a semi-liquid preparation of clay, or "slip," of a quality which burns to the contrasting colour or colours of the pattern. This "slip" not merely fills, but overflows the impression, and leaves the tile covered with a rough coating, in which state it is taken to the drying kilns, and in perhaps forty-eight hours (often much more) it is brought to the consistency of bees-wax. In this state of the tiles a workman, provided with a flat steel blade or scraper, proceeds to scrape down or shave off the superfluous coating of overflowing "slip" on the surface, and he continues this operation until he has removed it exactly down to the original surface of the tile, so as to bring out the pattern sharply and distinctly. The tile is then ready for the burning kiln. The burning occupies, in all, about a week, half the time being occupied in gradually raising the heat, and the other half in as gradually letting it down. This stage of the manufacture requires much care, as is indeed the case with all the finer kinds of terra cotta and pottery. The goods gradually shrink in burning, and the progress of the burning is indeed judged of from the appearance of proof tiles, introduced with the charge, and successively withdrawn, as the fire is got up and let down. The shrinkage is not always uniform, and tiles intended to be of the same size, inasmuch as they were formed in the same mould, often differ so much in their dimensions after burning that they cannot be laid in the same pavement. They are, therefore, carefully gauged, and assorted into lots each of one size.

Tiles so made are comparatively indestructible. A sharp file will hardly cut them, and considerable exposure to the weather affects them but little. Ancient tiles are still found, sharp and apparently unchanged in colour, where stone of strong texture has crumbled almost into dust. Care is requisite, in order that the body clay of the tile and that introduced into the pattern have equal shrinkage, as otherwise the pattern will not be firmly attached to the body. Encaustic tiles made from well selected clays and properly burnt, will not, when broken up by a hammer, show any separation of the veneering from the body, or of the pattern from the veneering. In other words, a fracture across any joint between different clays will bring off portions of both in each and every fragment broken off.

But apart from pugging the clay, and first drying and afterwards burning the tile, the process of hand-moulding is not a rapid one. A good workman will mould from 200 to 220 tiles, each six inches square, and in two colours only, as an ordinary day's work. Plain tiles, or those in one colour, are moulded at the rate of only 750 quarries, each six inches square, per day, although very rapid workmen may turn out as many as 1,000. In the Potteries it is estimated that the cost of labour only in moulding and trimming encaustic tiles is from 1s. 9d. to 6s. per dozen tiles, or from 5s. 3d. to 18s. per square yard, according to the intricacy of the patterns and the number of colours filled into them. This may be much cheaper than mosaics, but the expense is still sufficient to preclude the use of encaustic tiles in a vast number of cases, where, but for their cost, they would be most usefully and suitably employed. Where, on the one hand, the architect can command the means requisite for the best class of ornamental paving, he will naturally select the smaller and richly variegated *tesseræ*, arranging them in mosaics of his own or of some approved design; but where he is limited to encaustic tiles, the very considerable difference between the cost of the plainer and the more elaborate designs will oftener induce him to employ the former to the sacrifice of effect. And where the choice lies only between tiles and oil cloth, the latter, although not nearly so durable, will commonly produce by far the best effect for the money.

It must have long ago occurred to many persons interested in constructive and decorative art, that to introduce encaustic tiles extensively it would be requisite that they were made by machinery. It is a singular thing that the art of working in clay—possibly the earliest of all the arts practised by man—should have been almost the last to derive advantage from mechanical ingenuity. Not but that there have been many attempts to employ machinery in brick-making; but even here it is but a few years, very few, indeed, since machine-made bricks were scarcely known. It is ten years only since the first step was taken towards the manufacture of encaustic tiles by machinery; the son of the late Mr. Samuel Wright, the inventor of the hand process already described, having, as a joint inventor, obtained his first patent in 1855. The encaustic tile machine, the joint invention of Mr. Samuel Barlow Wright and Mr. Henry Thomas Green, has been successively improved, until it now appears to have been perfected, and it is in successful use in the Potteries, although not to an extent commensurate with the importance of the new manufacture. The machine is very simple, and its general construction and mode of action may be easily understood from a verbal description and without illustrative drawings. At one end of the machine are three common pug mills, placed side by side in a row, in the direction of the length of the machine. The middle and larger mill is for pugging the coarser body clay, the other mills at the same time tempering the finer clay for the top and bottom veneering of the tile. The three pug mills discharge their clay in three continuous streams, between a pair of polished rollers, which compress; and, so to speak, weld the three streams into one. This is received upon, and carried forward by, an endless travelling table, or band, which extends horizontally for the whole length of the machine. As delivered upon this table, the compound stream of clay is of the intended thickness of the tile before burning, and of a little more than its intended width. It first passes under an impression roller, perhaps two feet in diameter, and around the circumference of which are fixed the plaster dies, corresponding to the intended encaustic pattern on the face of the tile. In the old or hand process the die is flat, and the face of the tile is formed by pressing the clay equally over its whole surface. In the machine the convexity of the die does not admit of a simultaneous impression of the entire pattern over the whole surface of the tile, the place of deepest impression, at any moment in the progress of the clay, being in a line across the width of the tile. But, notwithstanding this fact, and that the alto-relievo surface of the die (being one-eighth of an inch or so further than the bottom from the centre of the impression roller) moves forward about the one-hundredth part faster than the surface which presses upon the face of the tile, the impressions are nevertheless sharp, no matter how intricate the pattern may be. The impression-roller, as well as all the other working parts, must be driven so as to correspond exactly with the progress of the travelling table, or, in other words, with the progress of the advancing stream of clay. It will be understood that the impression-roller does not revolve by friction merely, as the clay is drawn under it, but that it is driven by gearing, at a definite speed, or, as mechanics would say, it has a positive motion. As soon as the continuous slab of clay has received the intended impression, it is cut into lengths corresponding to the intended size of the tile. This is effected by a guillotine wire cutter, which rises and falls at definite intervals, cutting the clay in its descent. Although the action of this cutter is only in a vertical direction, it is so arranged that, during the brief interval while it is passing through the clay, it shall move forward with it, returning again to its original position after the cut is completed.

Simple as all the parts, so far described, may

appear to be, everything depends upon absolute synchronism in their action. A greater amount of ingenuity, or, perhaps, it will be more truthful to say, of ingenious perseverance, has been devoted to this point than those unacquainted with the constant, but seldom recorded, skirmishes on the outposts of invention, would perhaps believe. Six years ago, my friend, Professor Hughes, or rather, his representative, Mr. Henry Hyde, described in this room his beautiful type-printing telegraphic instrument, to which, perhaps, we owe the introduction of the shilling telegram, which promises to become as general throughout Great Britain as the penny postage of Sir Rowland Hill. As in Messrs. Wright and Green's tile-making machine, so in Professor Hughes's telegraphic instruments, everything depends upon synchronous action, and this has been at last secured, beyond all doubt, in both inventions. In the tile-making machine the rate of progressive motion is about twelve feet per minute, corresponding to the moulding of twenty four 6-inch tiles per minute, or to 14,400 in ten hours, as compared with 200 or so moulded by hand in the same time. It is absolutely necessary that the pug mills deliver at the prescribed rate, that the polished compressing rollers move at that rate, and that the travelling table, the impression roller, and the guillotine cutter exactly conform to it. The rate may be 10, 12, or 20 feet per minute; but, whatever it is, all the parts of the machine must, as they do, work in perfect concord with each other.

After the advancing slab of clay has been cut into tiles, it passes under a reservoir or trough, of which indeed the procession of tiles forms the bottom, and within which the clay for the contrasting colour of the pattern is mixed with water to the consistency of "slip." The slip is filled into the impressions upon the tile, and overflows the whole surface of the tile to the depth of perhaps an eighth of an inch. The tiles are taken from the travelling table as they emerge from the end of the slip trough, and are conveyed thence to the drying kilns, where they remain until they are of the firmness of wax. They are then taken to a machine, consisting of a vertical spindle, in rapid revolution, and having one or more cutting blades fixed to its lower extremity, and revolving in a horizontal plane, as in one form of planing machine for planing wood. The tiles are placed, one by one, upon a horizontal bed-plate, which can be elevated or depressed through a small range beneath the revolving cutters, are rapidly surfaced, the overflowed slip being removed, and the pattern brought sharply out. This operation is almost instantaneous, and it leaves the tile with its two surfaces absolutely parallel with each other, and insures perfect equality of thickness in any number of tiles surfaced. Thence the tiles are squared to gauge upon the flat revolving side of a large grindstone, and, this operation being over, they are ready for burning.

The machine, with two or three attendants, does the work of from sixty to a hundred hand moulders. It works the clay more uniformly into goods than can be done by hand, and the slip pattern is deposited with more uniform density and with less risk of imprisoned air, so that the pattern burns better, and is still less likely than in hand-made goods to crack out from the body of the tile. Nothing, it is believed, can exceed the soundness and truth of the machine made tiles here upon the table; the patterns being as integral with the veneering, and the veneering with the body, as if the various clays had been actually incorporated together into one homogeneous mass. On the other hand, although the machine can make tiles with most intricate and delicate designs, even to the filiform tracery or tendril like stalks of the most curious arabesques, it can only make bicoloured tiles, as the details of the pattern can only be filled from one and the same trough of slip clay.

Another, and possibly a still more important purpose of the machine is that of making both intaglio and relievo ornaments upon slabs of plastic clay, to be burnt into terra cotta decoration for walls. In this way cheap and most durable friezes and dados, enriched antæ, and other work, whether anaglyphic or sunk, and, indeed, ornate slabs for covering the entire *façades* of buildings, may—if we disregard the extra cost of the finer clay required—be made almost as cheaply as bricks themselves. No matter how enriched may be the design, these slabs, of which we have samples here, may be produced by one machine at the rate of 5,000 square feet per day, equal to the encasing of a *façade*, allowing one half its surface for windows, of 200 feet long and 50 feet high. Such ornamentation, produced by hand moulding, has been more or less employed for a long time, but it is costly in the first place, and it is commonly made of a close-grained clay, which does not withstand the weather as it ought. By the aid of machinery, with its increased power of compression and consolidation, a more open and durable quality of clay—that is one having more silica—may be employed; and at the same time still larger slabs may be produced. The known cost of production is so low that it may be at once declared that such slabs may be sold at a cost below that of rough stone, at the quarry or without labour, the plainer slabs being sold at 6d. per superficial foot, and the enriched patterns, which are made with almost the same facility, at from 9d. to 1s. 6d. Ordinary bricks are now made by machinery, with projecting dovetails, and these bricks may be built into walls so as to project from two inches to two and a half. The terra cotta slabs are formed with corresponding grooves. When the brickwork is raised to the height of one course of blocks, these are affixed, and the joints run with cement grout; and the *façade* of slabs is secured in successive courses in the same manner until the whole is complete. In this way a building of a richly ornamented character could be erected in less time, and at as little cost, as the present unsightly structures in brick.

It may be that enough has been already said of the commercial advantages of the new manufacture. Far more might, however, be added. In the presence of so practical an assembly as this, it may be as well to enable those who are disposed to check every statement of the cost of production, to do so with the light already derived from experience in working the new machine in the Potteries. For a production of 12,000 6-inch tiles per day, or 2,000 square yards of tiles per week, about 72 tons of body clay and 48 tons of slip or veneering clay, would be required weekly. In certain localities, furnishing the required qualities, the coarser clay can be raised and moved for 3s. 6d. per ton, and the finer for 7s. 6d. per ton, including royalties, making £30 12s. weekly for clay. The coloured slips might cost £10 more. The wages of men and boys at the machine are taken at £6 14s. per week, and the cost of labour in facing and edging tiles as £25. The cost of setting, burning, and drawing the tiles may be set down as £18 more per week. The coal for drying and burning, and for the engine, may be taken as £20; the cost for warehousing, sorting, and packing as £10 per week; wages of engine-driver and fireman as £3; and wear and tear, oil and grease as £5. The cost of management, clerks, and designs would be, say £21 per week; rates and taxes, £1 6s.; commission on sales (£450 weekly at £10 per cent.), £45; stationery and advertisements, for the first year, £22; loss and contingencies, supposing them to be £20 per cent. upon the whole sales, £90; and interest on capital expended, say £30. This makes in all, £337 12s., or say £16,800 per annum. The sales, on the other hand, at 2,000 square yards weekly, for 50 weeks in the year, at the low price of 4s. 6d. per square yard, which is less than the cost of labour alone in making hand-made tiles of equal quality, would amount to £22,500, leaving £5,620 profit, or about 22½ per cent. profit upon a fixed investment of £25,000, in itself ample for the working of a single machine. The profits upon an additional investment to the same extent, in the department of terra cotta or ceramic decoration, making 30,000 square feet weekly, to be sold at 6d. per foot, would, upon the ordinary experience of

potters, be quite as great. These details, the result of careful inquiry and of accumulated experience, are given rather to show the advantages in cheapness and in the character of work obtainable in the new manufacture. The architect—as are nearly all who are engaged in the arts of construction—is more or less bound in his designs by commercial considerations; and to give him a known material at a cost commercially within the limits of general application, where previously it could only be sparingly employed, is virtually to give him a new material.

DISCUSSION.

Mr. GARLING said he had been much interested by the paper that had been brought before them. The whole operation described appeared to be a very practical one; and the details given with regard to cost and to the working of the machinery tended to give him a favourable impression of the invention. These tiles afforded a pleasing form of architectural ornamentation, and any means of cheapening their manufacture could not fail to enlist the sympathies of all interested in the progress of art. The machinery by which this object was accomplished, the particular kind of material used, and the design applied to it, were all important elements in this production, and on all these points the statements of Mr. Colburn appeared to be very satisfactory. He was not aware that any observations he could make would render more clear the explanation already given, because he thought each branch of the process had been described in sufficient detail. The designs shown were very beautiful, and the cost of production by machinery was not only a great deal less, but the results were superior to anything that could be produced by manual labour, and as these tiles would thus be made in larger quantities than formerly they would be more available to the architect and the builder.

Mr. SPENCER GARRETT had listened with great pleasure to a paper on a manufacture with which he had been connected for many years past. He had heard of this machinery from its first introduction, and it had afforded him much pleasure to be informed, from time to time, of its progress. He regarded it as a great discovery, and the condition to which it had arrived was, in his opinion, only the first-fruits of what might be looked for hereafter. The improvements still to be made were, doubtless, very considerable. He ventured to make this statement as a practical potter, and he would be only too happy to aid the progress of this manufacture by all the means in his power.

The CHAIRMAN would be glad to hear from Mr. Colburn the process by which the pattern originally made flat was brought into a circular form and applied to the cylinder.

Mr. COLBURN replied that the pattern was formed by a circular mould.

Mr. BISHOP said he had been much interested in the examination of tesselated pavements in Egypt, especially those in a mosque near Cairo. The pattern on the tiles appeared to have been produced by a stencil plate, and the glaze poured or brushed on afterwards, and then burnt in. The pattern was not indented in the tile, as was the case at the Alhambra, where he was struck with the great variety of geometrical patterns that were formed, which were of a much more distinct character of outline than those produced by the stencil. He had also seen a very beautiful description of tile in houses at Tangiers, which was evidently of the same manufacture as those used in Spain.

The CHAIRMAN remarked that there were many interesting branches of this manufacture. There was a class of tile which was ornamented by the mixture of simple clays, and another class which was ornamented by the application of vitreous colours, which were more brilliant than the natural clays, and altered the character of the tiles entirely. There was a class of tile in use in India which consisted of a combination of both these modes of ornamentation; in these the pattern was first formed by the ordinary red and white clays, and then the whole tile was floated over with a glaze which gave it another colour. Some very beautiful specimens of tiles were brought over by the late Lord Canning, and were now to be seen in the Indian Museum. The patterns on these tiles appeared to have been produced by stencilling, except in some cases where the process which was common in the Norman tiles of the north of France was employed. A star or other ornament was made in a piece of clay of one colour, and the enclosing frame, completing the square of the tile, in clay of another colour. These were then interchanged in the same manner as in marqueterie work.

A question having been asked whether these tiles could only be made in two colours by the machinery,

Mr. COLBURN replied that at present that was the limit of the applicability of the machine; and, as far as he at present knew, was likely to remain so.

Mr. MATTHEWS added that he regarded the variety of colour as a very important point. As a young architect, desirous of using these tiles for exterior decoration, he was very anxious to hear what the probabilities of the future were with regard to the production of varieties of colour, the absence of which, he apprehended, would much limit the use of these materials.

Mr. COLBURN did not see how with the present machinery more than two colours could be introduced. The whole slab of clay passed under the trough, and, in fact, formed the bottom of the trough containing the slip or thin clay which gave the colour of the pattern.

The CHAIRMAN said that, in this manufacture, the application of improved machinery to the tempering of the clay would be a great advantage. At present the methods of preparing the clay for ceramic manufacture were somewhat barbarous, and he thought might be materially improved.

Mr. GARRETT added that the process of printing paper hangings in several different colours by one machine, had furnished him with some ideas in respect of introducing varieties of colour into this manufacture.

Capt. SYMONDS, R.N., might state, in the absence of the inventors of this machine, that he had seen it in full working, and its operations were minutely explained to him. The great point which was effected by the application of this machinery appeared to be the quantity of tiles delivered in a given time, and the consequent saving as compared with hand labour. He believed he was justified in saying it was in contemplation to carry out the suggestion of introducing more than one colour into the tiles. The inventors, as might be supposed, had many difficulties to overcome in producing the specimens now shown, but they were by no means discouraged from attempting to realise higher results.

The CHAIRMAN said one of the great difficulties at present with respect to tile-making in more than two colours was now overcome by hand-labour. For instance, let them call the original colour No. 1, and the second colour No. 2. If No. 1 made a complete form, it was easy to put in No. 2 by machinery; but supposing the pattern required that No. 2 should be put in, in immediate contact with No. 1, it was obvious that No. 2 could not be put in till No. 1 had become sufficiently hard not to mix with it. That was the difficulty of getting a second pattern into the tile. As the machinery was at present constructed, the slip which formed the second colour covered the tile, and no means had yet been suggested of introducing a third colour.

Capt. SYMONDS remarked that, allowing this difficulty, there was still great advantage in manufacturing tiles by this machinery, for even if a greater variety of colour involved a subsequent manual operation, there would still be a considerable margin in cost of production in favour of the machine.

The CHAIRMAN said that no doubt this would be so. He

added, that before the discussion closed he thought it desirable to direct attention to another application of this machinery, namely, the production of ornamented slabs with indented surfaces. Those would form an admirable facing for exterior walls, and be a good substitute for the Portland and Roman cement now employed.

After a conversation relative to the cost of producing the moulds,

The Chairman said he would now offer a few general observations upon what struck him as the most important points in the paper. In the first place, they might clearly recognise the improvements now effected in the manufacture of tiles, as analogous to those produced by cylinder as compared with block printing; and the modifications which were thus being effected in ceramic manufactures were of the same character as those which cylinder printing had introduced in the ornamentation of textile fabrics. To say that the result of the application of machinery to this particular branch of manufacture had been to economise the production of it to the extent of 4 to 1, was, he believed, a moderate estimate. Of course, in calico-printing, paper-staining, and also in chromo-lithography, the operation of giving the required number of colours was comparatively easy, because each cylinder as it passed did its work immediately. The great difficulty in this case was to bring the slip into such a consistency as that it could receive and retain an impression from succeeding cylinders. The only way, he apprehended, of introducing a second colour of pattern would be, after the first slip was passed over, to remove the tile to the kiln till the slip acquired a consistency which would enable it to retain a second impression, and then to place it again in the machine. Even then it would be necessary so to arrange the pattern as to make the first impression include the second colour. When the filling-in was got into a plastic state that would again be brought to the second cylinder, and, a proper register being preserved, the tile would receive a second impression, and then the second process of pouring in the slip would supply an additional colour. It was easy to do this by hand-work, but difficult by machinery, but this appeared to him a means of getting over the principal difficulty which hung over this manufacture by machinery. With regard to the wall facing slabs to which he had called attention, the main difficulty was their safe attachment to the wall. The material was heavy, and if frost attacked the mortar behind the slab, and it became detached, there would be great danger to passengers in the street. There must be some mechanical attachment other than that which could be provided by projections on the edges of the bricks it was to be attached to, with corresponding indentations in the back of the slab. The great difficulty in this plan was to properly fit the work. The desideratum was to provide a mechanical means of attachment which should allow this facing material to be used anywhere. Having described a patent which he took out for this purpose some years ago, but which he said had lapsed from not having been brought into use, owing perhaps to public taste not having then gone in the direction of this kind of ornamentation, the chairman suggested that some ingenious individual might probably be able to make some use of it in connection with these revived methods of architectural decoration. He then went on to remark that, apart from the consideration of the improvement effected in the manufacture of tiles, they must admire the extreme ingenuity of the machinery itself. The synchronous action of the machine in all its parts was essential, but this to a mechanical mind such as Mr. Colburn's was no difficulty at all. All who designed machinery upon systematic principles, took care to bear in mind not only the motion to be made but also the time in which that motion should be made. By means of a diagram on the board, of the cylinder used in the tile-making mahine, the Chairman pointed out a method by which he conceived the difficulties mentioned in respect of the synchronism of motion in the machine might be obviated; after which he remarked that there was another aspect in which this manufacture was most important, that was, in relation to its influence upon architecture and beauty. It was important, in choosing the colours to be employed, to avoid making the contrasts crude and violent when to be seen near to the eye, though, of course, when things were seen at a distance the contrasts might be made more striking. When we had this ready means of chromatic decoration, it behoved us not to abuse it or use it wrongly, but to take care that it was directed by true principles of art. The chairman concluded by proposing a vote of thanks to Mr. Colburn for his excellent paper, which having been cordially adopted,

Mr. Colburn expressed his gratification at the kind way in which his paper had been received, and his personal obligations to the Chairman for the able manner in which he had summed up the subject. Speaking from an architectural point of view, no doubt if encaustic tiles had been the fashion fifty years ago, machinery would have been provided to make them, but their general introduction, as was well known, had been quite recent, and it was only very lately that ingenuity had been directed to their production by machinery. The practical result they had arrived at was, that if this description of tile was wanted in large quantities, it could now be produced at such a low price that nothing made by hand-labour could compete with it.

Proceedings of Institutions.

Croydon Literary and Scientific Institution.—The report for last year states that the directors have become the actual lessees of the building, in which hitherto the Institution has only been a yearly tenant. The balance sheet shows that the income was £1,088 17s. 10d., and that there was a balance in the hands of the treasurer of £90 18s. 11d. The following are the numbers of members enrolled during the year:—First quarter, 837; second quarter, 796; third quarter, 717; fourth quarter, 544; quarterly average, 723. In comparison with the former year, there is a decrease of forty members, and £30 less in receipts from members. There was a large addition of life members, no less than 34 having been qualified as first-class members, and four as second-class. The summer fête resulted in a profit of about £7; upwards of 2,000 attended on the occasion. 292 volumes have been added to the library during the year; 249 volumes were purchased at an expense of £46 4s. 8d. to the funds of the Institution, and 43 were presented. The total issue of books for the year was, 9,312. Thirty one lectures and entertainments were given during the year, with an average attendance of 501. Amongst these may be mentioned:—Mr. Henry Vincent, on "Oliver Cromwell; Captain James Ricket (of Cotterstock), "The Sea: Ships, Sailors, &c.;" Dr. Daniel, "Lord Nelson;" Rev. A. B. Power, on "Heat;" Rev. J. M. Bellew, "Milton;" Professor Selwyn (of Cambridge), "The Sun;" Professor R. Hunt, on "Electrical Force;" Dr. Letheby, "Oxygen Gas;" Mrs. C. L. Balfour, "Lady M. W. Montagu;" Rev. J. M. Bellew, "Shakespeare;" Mr. Elihu Burritt, "The Physiology of Nations;" Mr. George Dawson, "Great Schoolmasters;" Rev. J. B. Owen (of Chelsea), "Cliques." Several were given gratuitously. The Committee mention with regret that Mr. F. Warren has announced his intention of retiring from the hon. secretaryship at the end of the present year. Mr. Warren has been the mainstay and the life of the Institution, and at the urgent solicitation of the Committee, he has reluctantly consented to continue his valuable services for another year.

Yorkshire Union of Mechanics' Institutes.—The annual meeting will be held at Stockton-on-Tees, on

Thursday, 8th June, in Whitsun-week. In the forenoon the conference of delegates will be held in the Borough-hall, when Mr. Edward Baines, M.P., the president of the union, will take the chair. The report of the Central Committee will be presented, and several interesting questions will be submitted for discussion. In the afternoon the delegates and other visitors will dine together at the Black Lion Hotel; and in the evening a public meeting will be held in the Borough-hall, at which the Right Hon. Thomas Headlam, M.P., Judge Advocate-General, will preside. On the Friday the delegates will have an opportunity of visiting the extensive iron shipbuilding yards in the neighbourhood, after which they will be conveyed by special train to Gisborough, to see the ironstone mines whence are derived the great mineral treasures of the Cleveland district; and the beautiful and picturesque seat of the Earl of Zetland, at Upleatham. They will then proceed to Saltburn, the new watering-place on the North-Eastern coast, where luncheon will be provided.

Fine Arts.

Paris Exhibition of Fine Arts.—This exhibition was opened on the 1st day of May, as usual, without any previous private view. The Emperor visited it just before leaving for Algeria. It is fortunate that Paris possesses such a building as the *Palais de l'Industrie*, otherwise it would be very difficult to find a place for these annual exhibitions, which are assuming colossal proportions. Last year the total number of works admitted by the jury, and exempt from previous examination, amounted to 3 086, including all classes—paintings, drawings, miniatures, enamels, sculpture, architecture, engraving, and lithography. This year the total is 3,559, although certainly the admission jury has not been more lenient upon the present than it was on the last occasion. The exhibition in separate rooms of such of the rejected works as their authors chose to leave for that purpose has not been repeated. Last year there were 1,150 pictures refused, two-thirds of which were immediately withdrawn by their authors, and the exhibition of the rest had such an effect that no one desired a repetition of the show. The rewards consist of two grand medals of honour, each of 4,000 francs value, forty medals, of the value of 400 francs each, in the section of painting, fifteen in that of sculpture and die sinking, six in architecture, and eight in engraving and lithography. In addition the jury has the privilege of recommending for the Legion of Honour any artist who may have received one of these medals on three occasions. All the medals are awarded before the opening of the exposition, and labels inform the public not only which works or which artists have obtained prizes, but also whether they were admitted by right, the artist having previously received certain distinctions or after examination by the jury; or whether they were *hors de concours*, in consequence of the artist being a member of the jury. The grand medals of honour have been bestowed upon M. Cabanel for painting, and M. Paul Dubois in sculpture. M. Cabanel's reputation is well established; he is one of the professors of the new governmental school of the Beaux Arts, a member of the *Institut*, and the painter of many works known by their photographs all over Europe. Amongst these, perhaps, the beautiful oval, *Aglaé et Boniface*, is the purest and most remarkable. M. Cabanel has only two portraits in the exhibition, but one is of the Emperor, who is painted in plain dress. M. Cabanel's is a very remarkable work, curiously unlike that of Flandrin in almost every respect; he has softened the features of Louis Napoleon, but he has shown more of the intellectual character than his predecessor. As regards technical execution this portrait is excellent. The other portrait is that of a lady in a purple velvet dress, a most refined and exquisite work. M. Paul Dubois, to whom the other grand medal of honour has been awarded, is a much younger man, who obtained a third class medal for sculpture in 1863, but failed to obtain any reward last year; the work which has thus been crowned is very charming. It is a statue of a Florentine youth, in the costume of the 15th century, singing to his own accompaniment on the lute. The face is full of serious energy, and the half-developed muscles of the youthful form exhibit intense study and most delicate handling. M. Dubois, like the great sculptors of old, does not confine himself to one phase of his art, but exhibits this year, as he did last, also in the section of drawings and sketches. He is a native of Nogent-sur-Seine and pupil of M. Toussaint, but not a laureate of the Academy. The works belonging to the class of painting are no less than 2,243 in number, against 1,995 last year. Two circumstances, amongst others, have contributed to alter, to some extent, the general character of the exhibition. In the first place, the absence of war, and the surfeit which the public has had of huge flashy battle pieces, have at once lessened the number of such works and greatly improved the remainder. The most remarkable battle piece in the Exhibition, a "Charge of Artillery," by M. Adolphe Schreyer, a young artist of Frankfort, (only known in the Paris world as having obtained a medal last year for a landscape with horses, which has been purchased by the government, after having been rewarded with a medal by the jury) is a simple, bold, serious work of high character. The whole main plan of the picture, which is large, is occupied by a gun, drawn by six horses with two artillerymen on horseback. The soldier who rides the near wheeler is wounded and falling back in his saddle, the horse has become entangled in the harness, and hangs back, while the others in full gallop drag it along. M. Pils, who gained the grand medal for his picture of the French part in the battle of the Alma, in 1861, and who is now one of the Professors of the Ecole des Beaux Arts, introduced, or at any rate confirmed, this new and wholesome mode of dealing with military subjects, which is adopted by Bellangé, Protais, and other eminent French artists. Of the other Professors of the School of Fine Arts, M. Robert Fleury, the director, does not exhibit, but M. Gérome contributes two works—one, a picture, painted by command, of the reception of the Siamese embassy by the Emperor at Fontainebleau. The Siamese are on all fours in the centre of the room, with the exception of the chief ambassador, who has reached the foot of the throne and presents his master's letter to the Emperor. The magnificent presents are on the steps of the throne, and there is a group of ladies behind the Empress. M. Gérome's other work, "Mussulmen praying on the house tops," is an effective picture. Amongst the most prominent works, besides those already mentioned, are two pictures in mediæval style by M. Alma Tadema, a pupil of Mr. Leys, of Holland; "Youth," by Aubert; "A Diana," by Baudry, who, however, has not achieved a great success this year; "The charge of the French cuirassiers at Waterloo," after Victor Hugo, by Bellangé; "Twelfth day in Alsace," by Gustave Brion; "A Jewish schoolboy of Tangiers," by Madame Henriette Browne; two charming groups of children, by Charles Chaplin; two pretty diminutive pictures, by Victor Chavet; two landscapes by Corot, in the great room, which were thought so admirable by half of the jury that they desired to bestow the grand prize upon that artist, and it was only finally awarded to Cabanel after 28 turns of the ballot-box—both being members of the jury; a fine moonlight scene, and a view of the park of Saint Cloud, by C. F. Daubigny; "Venus and Cupid," by Eugéne Faure; "View of the new excavations at Pompeii," by Français; "Falconry in Algeria," and "Robbers of the Sahara," by Fromentin; "Portrait of a lad in Turkish costume," by Gautier; a "Presentation," and "Monks at their studies," by Gide; "The death of the Princess de Lamballe in 1792," by Firmin Gerard; "Arrival of the Emperor Napoleon III. at

Genoa," a marine scene, by Gudin; Two charming little works by Herbert, entitled "La Perle Noire" and "The Stone Seat;" "A child's head," by Leopold Horovitz; "The Alchemist," by Isabey; "A Scene on the Sea Shore," by Le Comte; "Hylas," by Lenepken; "Skarga preaching before Sigismund III.," an excellent attempt at historical painting by a young Pole, pupil of the school of Cracow, and for which a medal has been awarded to the artist, Jean Matejko; two works by Meissonier; and the first exhibited production of his son, Jean Charles; the last-named is on a larger scale than the works of the elder artist, but the treatment is of the same kind and promises well; "Jason," and a composition entitled "The Young Man and Death," by Gustave Moreau, the painter of the "Sphynx," which was the most remarkable picture of last year's *salon;* Interiors of the galleries of the Louvre and of Fontainebleau, by Navlet; "A fête in the time of Henry II.," by Arnold, son of Ary Schaeffer; "Cinderella," by a Belgian artist, Joseph Van Lérins; "The Empress Josephine before the coronation," by Viger-Duvignau; and two views in Venice and Verona by Mr. William Wyld. A large number of eminent names are absent from the catalogue, and some of the ablest of the exhibitors have sent works of small importance; but on the whole, however, there is such immense profusion and variety, such a general acquaintance with form, and so much power in its delineation, so much knowledge of colour and harmony, although, according to English notions in general, pitched in too low a key, that no young artist, who can afford to pay an annual visit to the Paris exhibition, should omit to do so. He can find nowhere else such a mass of contemporary art, or see at once the works of so many existing schools, for the Paris exhibition includes a large number of works by other than French artists. The total number of painters exhibiting is 1,567, of whom 1,300 are French, and 267 belonging to other countries. Of the latter 60 are Belgian, 34 Prussian, 31 from other parts of Germany, 21 Swiss, 19 Italian, 17 Russian, 17 Dutch, 14 Austrian, 12 Spanish, 9 English, 9 American, 5 Polish, and as many Swedish, 4 Norwegian, 3 Hungarian, 2 Danish, and as many Hanoverian, and one each from Portugal, Peru, and Egypt. But of these 267, rather more than one quarter, have been educated, either wholly or in part, in France, and thus belong to the French school. Of the wholly foreign element the Belgian is by far the most important, there being fifty artists educated in Belgian schools in the list of exhibitors. The next most important element is the Prussian, and indeed, taking the whole of Germany together, its artists rather exceed those of Belgium. Half the Swiss exhibitors have been educated in France, but less than a third of the Italians and Russians, while nearly the whole of the Austrians and Dutch are educated in their own countries. It appears by the official report itself that there were alive on the 1st of January in the present year 800 painters, 200 sculptors, 160 architects, and about 130 engravers and lithographers, who had received medals or other honours.

Manufactures.

Anglo-French Working-Class Exhibition. — An International Working-Class Exhibition is now being organized by a committee of English workmen, with whom their French brethren appear to be heartily co-operating, and the present year being the fiftieth anniversary of peace between Great Britain and France, may be regarded as a peculiarly suitable opportunity for such an undertaking. It will be held at the Crystal Palace, Sydenham, and is to be opened on Saturday, July 29th, and to remain open during the months of August, September, and October. Among the patrons are M. Michel Chevalier, M. Girardin, M. Arles Dufour, Thomas Baring, Esq., M.P., G. J. Goschen, Esq., M.P., Stephen Cave, Esq., M.P., Charles Buxton, Esq., M.P., Walter Morrison, Esq., M.P., Robert Hanbury, Esq., M.P., George Lyall, Esq., M.P., and J. G. Hubbard, Esq., M.P. English and French employers and workmen are invited to send specimens of skilled work; journeymen to exhibit in their own names; and employers, in addition to their own, must state the names of the men who made the articles shown. Clever workmen will thus have an opportunity of obtaining public recognition of their skill, while firms who employ them will, in all probability, extend their business by sending highly-finished goods to this the first international working class show. Prizes will be given for excellence of workmanship, and a bronze commemorative medal will be presented to every exhibitor as a souvenir of the peace jubilee. To enable exhibitors to superintend and arrange their goods, a free pass for the season will be issued to each person whose work is accepted; but the committee wish it to be distinctly understood that they do not bind themselves to accept every article offered. All articles sent for exhibition will be taken the greatest possible care of, but the committtee will not hold itself liable for any loss or damage whatever. Things may be sold, but not removed until the close of the Exhibition. French workmen living in London are especially invited to compete with their British friends upon this occasion. It appears that a deputation from the London Committee was received with great enthusiasm in Paris; and at a meeting of delegates from the various Trade and Co-operative Associations, held at the offices of the Society of Crédit au Travail, a committee was formed who will receive goods from all parts of France and forward them to the Crystal Palace. From the ready support given to the movement by all classes in Paris, a very imposing collection of French goods is anticipated. English exhibitors are requested to make early application for space, which will be granted free, but all goods intended for exhibition must be delivered, carriage paid, at the Crystal Palace, not later than July 22nd. All articles not sold must be removed from the Crystal Palace within a fortnight after the close of the Exhibition at the exhibitor's own expense. For further particulars, forms of application for space, &c., apply to the Secretary, Mr. R. Coningsby, Crystal Palace, Sydenham; or to M. Edmond Potonie, 3, Rue Baillet, Paris.

Manufactures in Ireland.—A meeting was held on the 12th instant, at 29, Cannon-street, to consider the best means for introducing new and extending existing manufactures in Ireland. The chair was taken by the Marquis of Clanricarde, and among those present were:—Lord Dunkellin, M.P.; Colonel Dunne, M.P.; J. Pope Hennessy, M.P.; J. F. Maguire, M.P.; J. A. Roebuck, M.P.; Colonel French, M.P., and many others. The Chairman said they had met to consider what description of manufacture should be introduced into Ireland so as to receive the support of English commercial men. He was sure if a company were formed it would receive the best support which himself and other gentlemen could give. Mr. J. O. Lever, M.P., then explained that the object proposed was to erect a number of mills in different parts of the country, for weaving union cloth, an article in extensive demand, composed of linen and cotton. They contemplated the erection of ten mills for the purpose, and proposed to employ a capital of £1,000,000, consisting of 5,000 debenture bonds, bearing 6 per cent. interest; £200,000, in 10,000 shares to be applied in payment for land, &c., in Ireland; a like sum to be applied in payment for machinery in Lancashire; and 5,000 £20 shares for allotment and distribution to the public. He had found some of the best engineers in England who were willing to supply the machinery, taking one-fifth of the cost in shares and giving reasonable time for the payment of the remainder. They contemplated employing a new patent of Mr. Dickson for spinning the cotton and flax in the same yarn, by which one of the objections to ordinary union cloth would be obviated. The cost of erecting the mills would be £1 per spindle. Mr. Maguire, M.P., did not think mills could be erected at so low a cost. Mr.

Kirk stated that the erection of mills at the price named was easily accomplished. Mr. Dickson said he had tried his plan to some extent, and it had proved remunerative. After some further discussion, the following gentlemen were appointed a committee to consider the subject:—The Marquis of Clanricarde; J. Ennis, Esq., M.P.; Lord Claude Hamilton, M.P.; J. F. Maguire, Esq., M.P.; Colonel Ffrench, M.P.; R. P. Dawson, Esq., M.P.; J. O. Lever, Esq., M.P.; and J. Pope Hennessy, Esq., M.P.; with power to add to their number.

Colonies.

The Census of Canterbury gives the population of the province at 32,253 souls, of whom 18,932 were males and 13,321 females. The total number of acres of land fenced was 342,416, of which there were in wheat, 13,328 acres; in oats, 14,672 acres; in barley, 2,432 acres; in maize, 107 acres; in potatoes, 1,752 acres; in gardens and orchards, 220 acres; in artificial grasses, 31,670 acres; and other crops, 2,564 acres. The stock returns of the province give 10,868 horses, 62 mules and asses, 45,263 cattle, 1,567,320 sheep, 769 goats, 10,228 pigs, and 73,745 poultry. The census of 1862 gave the population at 16,040, so that it has more than doubled in three years.

The Statistics of Wellington show the population of the province to be 14,938, an increase during the last three years of about 18 per cent. The total quantity of land under crop, exclusive of artificial grasses, was 8,130 acres. Of land under grass there were 90,286 acres. The live stock—7,265 horses, 49,200 cattle, 401,502 sheep, pigs 13,072.

Trade of Maryborough, Queensland.—The gross value of the imports during 1864 was £112,412, and the gross exports during the same period were £123,246, and it is expected this year that coal, sugar, and other articles will be seen in the list of exports.

Progress of Queensland.—Marked progress was made last year in the Wide Bay district. Notwithstanding the severe test brought to bear on the farming population by the disastrous floods at the commencement of the year, the agricultural prospects are very promising. A large quantity of land has been taken up during the year, and a considerable increase made to the number of farmers resident on the Mary. Much attention has been directed to sugar-growing. A large area has been devoted to the growth of the cane, and two sugar mills are being obtained from England. During most of the year the timber trade has been greatly developed, and the immense cedar and pine forests have been keeping three local saw mills in active employment. Pastoral interests have been steadily advancing. The Burnett, although tested by two or three wet seasons, has maintained its high reputation for the growth of wool and healthiness of its sheep; and while other parts of the colony have been suffering from pleuro-pneumonia, neither the Wide Bay nor Burnett has exhibited a solitary case of that deadly scourge. A very fine seam of coal has been discovered on the Upper Mary, cropping out on the bank of a navigable portion of the river.

Notes.

Geologists' Association.—The first excursion of the season took place on Tuesday, the 9th inst., when the members visited Swindon, to examine the beautiful sections of Portland oolite, Purbeck, and green sand, which are displayed in the quarries of that neighbourhood.

Working Men's Exhibition for the City of London.—A deputation of members of the committee formed for organising a "Working Men's Exhibition for the City of London," waited by appointment upon the Lord Mayor on Thursday, the 11th May, to present a requisition signed by nearly 2,000 working men, and to solicit his lordship's co-operation in promoting such an exhibition. The deputation was introduced by Mr. Deputy Obbard. His lordship consented to take the matter into consideration and communicate with the secretary at an early date.

Correspondence.

WEAR AND TEAR OF STEAM BOILERS.

Sir,—A letter from Mr. D. K. Clark, in your last impression, conveys against me a charge of plagiarism in a way as courteous as it appears to me unmistakable. If I do understand that gentleman rightly, he labours under the slight misapprehension of thinking that I derived the explanations I gave of the pitting and furrowing of boiler plates from his work on the "Recent Practice in the Locomotive Engine." As he was so good as to re-publish last week, in your columns and those of a contemporary, all he has written on these subjects, and as I had the pleasure of laying the results of my little investigations before the Society on the 26th ult., anybody who chooses to take the trouble can easily form his own opinion on the sufficiently-unimportant question at issue. But I fear that few will take this trouble, and therefore, in justice to myself, I shall now proceed to show, in an easily-accessible form—

1. That my explanations, such as they are, of the phenomena of pitting and furrowing are quite distinct from those given by Mr. D. K. Clark.

2. That everything which he adduces as explanatory of furrowing and pitting was published by others years before the issue of his work on the "Recent Practice in the Locomotive Engine."

3. That such publication could hardly have been unknown to Mr. D. K. Clark at the time (1860) he published his own book.

4. That the very little information I have derived from his work has been fully acknowledged by myself.

I will now proceed to prove these small matters by a verbatim reference to the original documents:—

Mr. D. K. Clark's Theory, *in extenso*, of the Pitting of Boiler Plates.

(Published in 1860, *at page* 15 *of "Recent Practice in the Locomotive Engine."*

"*Furrowing of Boilers at the Joints.*—Probably the most important practical reference to be drawn from the tests of the strength of rivetted joints, is the explanation they supply of the failure, hitherto unexplained, of boiler plates, not at the joints, but in their neighbourhood. We are aware that electrical and galvanic action are freely adduced in explanation. But these words have two meanings—they mean electricity and galvanism; and they mean ignorance and mystery. It is known that boilers fail by corrosive and other agencies eating into the plates on the inside, pitting and furrowing the surface. The pitting of the metal is readily explained by the presence of chemical agents in solution in the water, and the known inequality of substance of iron plates and bars, in consequence of which the metal is gradually but unequally separated and dissolved; and probably a weak

A Portion of Your Correspondent's Explanations.

(See the "Society of Arts' Journal" of April 28th, p. 394.)

" . . . . . The presence of a concentrated solution of an acid or alkaline character, kept at a high temperature for years in contact with iron plates, would be sufficient to account for much corrosion. But the internal corrosion of steam boilers has many features of such a mysterious character, that no accredited explanation of its attendant phenomena has yet been put forward. In the first place, plates thus attacked show a number of irregular holes, like a pock-marked human face, or like the small craters seen on the moon's surface. The writer has also sometimes observed two or three little irregular excavations like this in a plate otherwise showing a large surface quite intact. Sometimes the plate is most pitted round a projecting bolt; at others, one plate will be perfectly sound, while that rivetted to it will be almost eaten away, both having been the same time at work, and under, of course,

galvanic circuit may be established between the iron shell and the brass tubes, accelerating the process of dissolution."

Most of the above is contained, almost verbatim, in the following letter, addressed by Professor Tyndall to Lieut.-Col. Wynne, R.E. It was printed and published in 1856, in the very same "Report of the Board of Trade on Railway Accidents" to which Mr. D. K. Clark refers at page 15 of his book. This letter was also included in a circular sent, in 1855, to all the railways in the United Kingdom by the Board of Trade.

"MY DEAR SIR,—In placing before you the reflections suggested by our joint examination of the boiler which exploded some time ago at the Swindon Station of the Great Western Railway, I have to express my regret that the absence of safe experimental data on the question of steam boiler explosions generally renders every opinion upon the subject in a great degree conjectural and uncertain. Our two hours' examination, instead of enabling us to assign the exact source of the actions which led to the destruction of the boiler, merely suggests the mode of attacking the question. While venturing, therefore, upon the following remarks, I cannot help feeling how much more satisfactory it would be to be able to substitute for supposition, however probable, the surer evidence of experimental fact.

"The appearances presented by the boiler were as follows:—The iron plates, as far as the water usually extended, were deeply pitted and furrowed by some corrosive agency. At the centre portion of the boiler, the pits, I think, were deepest and best defined; towards the end at which the cold water entered to feed the boiler they were less pronounced; towards the end nearest to the fire-box they were more diffuse and general. While pondering over these curious appearances, my attention was attracted by the tubes which passed through the boiler; these were of brass, and were attached at one end to the fire-box, and at the other end to the smoke-box of the engine. In the normal condition of the boiler these tubes were separated from the bottom and sides by an interval of an inch or two, this interval being usually filled with hot water.

"Without pretending to a degree of confidence unwarranted by the circumstances of the case, I think it may be apparently exactly similar conditions. With locomotive boilers this pitting has been ascribed to galvanic action between the brass tubes and the iron plates. But it is notoriously well-known to locomotive superintendents that boilers with iron tubes are often worse pitted than those which have run the same distance with brass tubes. Besides, all iron boilers, with or without brass, whether used for stationary, locomotive, or marine purposes, are subject to pitting.

"An explanation which seems to meet all the circumstances of the case is the following:—Mr. Mallet, in a report addressed to the British Association some years ago, showed that wrought iron and steel (blister steel probably) 'consist of two or more different chemical compounds, coherent and interlaced, of which one is electro negative to the other.' In fact, ordinary wrought iron, being also welded up from differently worked scrap, is far from being an electro-homogeneous body. In a boiler, the hot water, more or less saturated with chemical compounds, is the exciting liquid, and the electro-positive portions of the plates are thus quickly removed to a greater or less depth. This explanation meets most of the known circumstances with respect to pitting; it even, in a great measure, explains how plates above the level of the water, especially in marine boilers, get very rapidly corroded in portions, while another part of perhaps the same plate is scarcely affected. The concentrated water in a marine boiler is known to be generally acid. 'Of all the salts contained in sea water,' says Faraday, 'the chloride of magnesium is that which acts most powerfully on the plates. He shows that a cubic foot of sea water contains 3·28 oz. of this salt; and at the same time, points to the danger of voltaic action in a boiler through the contact of copper and iron. In a smaller degree, the contact of cast with wrought iron, or between the different makes of wrought iron in the same plate, or between contiguous plates, acts in the same way. It is not improbable that some hydrochloric acid is present in the steam of marine boilers. 'Mr. J. C. Forster has tested some of the condensed steam from the safety valve casing, and from the cylinder jacket of the Lancefield, and found both decidedly acid.' With an exciting liquid in the condensed steam, it is thus explicable how the plates of marine boilers often get corroded in a most capricious affirmed that such a boiler constitutes a veritable voltaic couple, consisting of brass, iron, and the exciting liquid, water. Feeble currents of electricity will be established, the direction of which through the liquid will be from iron to brass, the iron being what is called the positive element of the couple. A decomposition of the water will take place, hydrogen will be liberated against the brass tubes; oxygen (and acid, if a salt be dissolved in the water) will be liberated against the iron plates. The quantity thus evolved may be very small, but, acting incessantly for a number of years, it would, I imagine, be sufficient to produce the observed corrosion.

"In the course of our examination you directed my attention to the singular preservative influence which the fire box seemed to exercise on some iron bars which passed through it. There were, I believe, four such bars—solid cylinders, which passed, as longitudinal stays, from the front to the rear of the engine. Up to the point where these bars entered the steam dome they were deeply corroded; in the steam dome they were comparatively unaltered. This seems to be in harmony with the foregoing explanation. Up to the steam dome the iron bars ran side by side with the brass tubes which traversed the boiler; at the steam dome the brass tubes ceased, and from this to the end of the boiler, the iron bars, instead of being electromotors, were merely the conductors of the currents generated where the bars and the tubes were in close proximity. Other explanations may possibly be suggested, the exact merits of which experiment alone can decide.

"Parallel to the row of rivets which united the bottom plate of the boiler to the smoke-box, a deep furrow had been eaten into the plate. A similar corrosive action was not observed parallel to the corresponding row of rivets at the fire-box end. Parallel to one longitudinal row of rivets a furrow had been eaten so deep as to reduce the thickness of the plate from three-eighths to less than one-eighth of an inch. Along this furrow the boiler is supposed to have given way; the plates were torn asunder, and the total destruction of the boiler was the immediate consequence.

"Now, whatever be the cause of the corrosion, whether we refer it to the oxygen held in solution by the water, or to the decomposition of the water itself, science probably furnishes the means for its prevention. The experiments of Pepys, Davy, Van Beck, and others show that, by suitably connecting a more positive metal with iron, the corrosion is diverted from the latter, so that it is thus possible to preserve iron uninjured in a liquid which, under ordinary circumstances, would rapidly attack it.

"If the explanation which refers the corrosion to electro-chemical decomposition be the correct one, then in boilers where iron tubes are used, instead of brass ones, the pitting and oxidation ought not to take place to the same extent. I say 'to the same extent' because a difference in the manipulation of two pieces of iron is sufficient to destroy their electro-homogeneity, and to produce feeble currents when the pieces manner; while, at the same time, the current of steam would create a certain amount of friction on the oxide, clearing it away to act on a fresh surface.

The crucial test of this explanation of pitting would be the observation of the absence of the phenomenon from plates of an electro-homogeneous character. This homogeneity could only be expected from fused metal, such as cast steel. Accordingly, while the writer was in Vienna a short time ago, he was assured by Mr. Haswell, the manager of the Staatsbahn Locomotive Works, that some locomotives made of cast steel plates, in 1859, for the Austrian Staatsbahn, had been working ever since without showing signs of pitting, though under similar conditions iron plates had severely suffered in this way. Pitting may thus be fairly defined as a form of corrosion localised to particular spots by voltaic action. It is also probably aggravated through the motion of the plate by mechanical action, and the expansions and contractions from alterations of temperature. All boilers are most pitted near the inlet for the feed water, and with inside locomotive boilers there is generally more pitting at the smoke-box end—no doubt caused by the more or less racking action on these plates. A state of corrosion at particular spots would probably be kept up to a greater intensity by the incrustation being mechanically thrown off. With a quicker voltaic action caused by any unusual intensity of the exciting liquid, the sides of the cavities in the plates would be sharper, and less rounded off; as in the case of the boiler fed with mineral water from ironstone workings, which exploded last year, at Aberaman, South Wales."

are immersed in an exciting liquid. An action of this kind may, perhaps, be established between the iron rivets and the plates they unite, and, possibly, to this cause may be referred the furrows which are sometimes observed to follow the lines of junction. It would, however, be hasty to infer from a single instance that this is a general result; the whole subject demands a thorough examination, and a far wider acquaintanceship with facts than two hours' inspection of a single boiler could possibly furnish.

"The longer we reflect upon this subject, the more deeply must we be impressed with the necessity of associating, in the construction and management of steam boilers, the knowledge of the natural philosopher with that of the engineer. The consciousness of our deficiency in this respect was present with me when, on a recent occasion, I ventured to state that 'there are agencies at work in a locomotive of which the maker of it never dreamed, and which may, nevertheless, convert it into an engine of destruction.' At the present moment it might be difficult to say how many boilers are on the verge of explosion without any single engineer being aware of the danger. Another point deserving of attention is the following:—Common water always contains a quantity of atmospheric air in solution. This air may be expelled from the liquid by continued boiling, and it is an experimental fact that water thus freed from air possesses mechanical properties widely different from ordinary water. The cohesion of the liquid is enormously increased, in consequence of which it may be heated to a temperature far beyond its ordinary boiling point without boiling; but when it does boil it is not with the quiet ebullition of common water, the liquid particles snap suddenly asunder like a broken spring, and ebullition is converted into explosion. It is, I believe, a fact that boilers, after standing for a time, have often exploded at the precise moment when the engineer turned on the steam. The question presents itself, whether the action just referred to may not here come into play? If the water has been sufficiently purged of air and then left at rest, its augmented cohesion may permit of its being heated far above the boiling point due to the pressure upon its surface; the mechanical disturbance produced by turning on the steam would destroy this cohesion, and the superheated liquid would develop a force resembling that of gunpowder on the application of a lighted match. I would wish it to be borne in mind that we are in total ignorance as to the practical value of these suggestions; but the investigation which the subject so pressingly demands must take cognizance of them all.—I am, &c.,

"(Signed) JOHN TYNDALL.

"Lieut.-Col. Wynne, R.E., &c., &c."

The explanation I put forward differs, therefore, *in toto* from that of Mr. D. K. Clark. He first accepts the common stoker's notion of pitting, and ascribes it to some parts being "softer" than others. With this he jumbles up Professor Tyndall's observation about the brass tubes. He is entirely unaware of the three facts, amongst others, the bringing together of which has enabled me to put forward an explanation of the pitting of steam boilers:—1. That boilers with iron tubes are often more affected than those with brass tubes; 2. That cast steel boilers are not affected in the form of pock marks at all; 3. That common plate consists of interlaced portions, which are not electro-homogeneous—an important observation first made by Mr. Mallet, whom I quote. The weak galvanic circuit between the iron shell and the brass tubes, first alluded to by Professor Tyndall, and then adopted by his disciple, Mr. Clark, might account for an equally spread corrosion, but not for the "pock-marks." In truth, it has been noticed by many observers, amongst whom is Professor Faraday, that ordinary zinc plates in a galvanic battery are pitted in just the same way, and with an attendant loss of discharging force. Of course, Mr. D. K. Clark may have known every one of these things, but it was scarcely kind to his readers not to have published them.

MR. D. K. CLARK'S THEORY, *in extenso*, OF FURROWING.

". . . But this explanation does not meet the frequent case of a straight continuous furrow, cut like a groove, upon the surface. Furrows are observed to be formed parallel to, and close to, the rivetted joints. Not in any case, that we are aware of, have they been found at any notable distance from a rivetted joint, nor otherwise than parallel to one. The inference is inevitable that there is a relationship betwixt them; and our conviction is, that the alternate tension and relaxation of the plates at the joints, as the steam is got up and let down, are attended by an alternate distortion—incipient it may be—and resumption of the normal form, a bending and unbending of the plate on each side of the joint; in consequence of which the texture of the metal is gradually loosened in lines near to, and parallel to, the joint, and it is thus open to corrosive action. On this interpretation, the commencement of a groove or furrow, establishing a weak place, and concentrating the action there, would suffice to extend and deepen it to the dangerous limits occasionally announced by explosion.

"The weakness attendant on lap joints is strikingly exemplified in the lap-welded joint when subjected to extreme tension; the tensile strength, though the metal at the weld is perfectly solid and fully as strong in itself as the body of the plate, is much below that due to the regular section of the plate. Here there is no elementary weakness in the reduction of metal by rivet-holes; the inferiority of strength arises solely from the bending of the plates on both sides of the lap, and the overstraining of the fire-box in the endeavour to attain the position of stability.

"Mr. John Sewell, commenting on the corrosion of locomotive boilers, ascribes the furrowing of plates at rivet joints to the interruption of the vibrations of the boiler by these joints, the localisation of the fatigue at these places, and the increased susceptibility, in consequence, to corrosive action. This action has, doubtless, a tendency to aggravate the evil of lap-jointing; but we are disposed to ascribe the evil to the lateral bending and unbending of the plates as the primary cause.

"The furrowing of lap-jointed plates reads an important lesson on the real and intimately practical value of direct connection and direct action in exerting, transmitting, or resisting forces. That the furrowing of plates at the rivetted joints results from the indirectness of the strain of the steam pressure, is rendered still more probable by the analogous furrowing which results from reciprocating strains of another kind. In the more ancient classes of engines, in

A PORTION OF YOUR CORRESPONDENT'S EXPLANATION OF "FURROWING." (p. 388.)

. . . . "Emerson showed, more than sixty years ago, that the stress tending to split in two an internally perfectly cylindrical pipe, submitted to the pressure of a fluid from the interior, is as the diameter of the pipe and the fluid pressure. He also showed 'that the stress arising from any pressure, upon any part, to split it longitudinally, traversely, or in any direction, is equal to the pressure upon a plane drawn perpendicular to the line of direction.' As in a boiler the thickness of the metal is small compared with the radius, the circumferential tension has been assumed to be uniformly distributed; and the strain per unit of length upon the transverse circular joint being only half that upon the longitudinal joints, the strength of the latter has been taken as the basis of the calculations for the tensile strength of the joints. But in taking the internal diameter of the boiler as the point of departure, the internal section has been assumed to be a correct circle, which would only be practically true in the case of a cylinder bored out in a lathe, and never in that of a boiler. Two of Emerson's corollaries from his first proposition have in fact been neglected. He shows that if one of the diameters be greater than another, there will be a greater pressure in a direction at right angles to the larger diameter; the greatest pressure tending to drive out the narrower sides till a mathematically true circle is formed. The second is that if an elastic compressed fluid be enclosed in a vessel, flexible, and capable of being distended every way, it will form itself into a sphere.'* A number of proofs can be adduced that both these influences are more or less at the bottom of the wear and tear caused by the direct action of the steam.

"From 1850 to 1864 forty locomotive explosions, causing a loss of human life, have occurred in the United Kingdom. The Board of Trade reports in the blue-books presented to Parliament, and more especially those by Captain Tyler, R.E., probably form the most valuable and connected series

* The action of a fluid pressing with equal forces in all directions can be evidently represented as to force and direction by innumerable radii of equal length led from a single point in all directions. Upon this principle may be explained the spherical shape of soap bubbles, or the bulbs of thermometers (blown while the glass was in a plastic state), of the thin india-rubber balls used as playthings, and which are formed by forcing air into india-rubber tubes closed at one end. Gas and air bubbles in water are necessarily flattened by the hydrostatic pressure. It is upon that principle that a gun of soft ductile iron often bulges out at the breech.

which the cylinders are fixed to, and work from, the smoke-box plates, the alternate forward and backward strains by the steam pressure on the piston have been observed to weaken, and to subject to corrosion and leakage, the substance of the plate along the edge of the angle-iron at the junction with the barrel. In further corroboration of this doctrine, Mr. Colburn states that he is not aware that any accidents from furrowing of boiler plates have taken place in the United States; and we believe that their immunity from accidents from this source is to be ascribed to the use of very thin boiler plates, quarter to five-sixteenths of an inch thick." (Pages 15 and 16.)

We will now see whence Mr. D. K. Clark got his notion "that the furrowing of plates at the rivetted joints results from the indirectness of the strain of the steam pressure." At page 6 of his work I find that he mentions, *en passant*, an able pamphlet published by Mr. A. H. Renton, C.E., in 1856, on Bertram's patent welding process (London: J. Scadding). This gentleman also furnished Mr. Clark with a number of experiments made at Woolwich by the Admiralty, in order to test the resistance of plate joints, and more especially Bertram's joint.

"The comparative strain," says Mr. Renton, "which the samples of single rivetting bore (though in some slight degree influenced by its length) was from 40 to 60 per cent. of that borne by the solid plate, the thinner plates bearing the larger proportion—that is, the strength of the three-eighth inch lapped plates was 60 per cent. of that of the solid plates, while that of the half-inch plates was only 40 per cent., whereas the proportionate section of metal between the rivets was $62\frac{1}{2}$ per cent. in both cases.

"It will be obvious from a reference to Tredgold's formula in the first vol., 'Trans. Inst. Civ. Eng.,' that the resistance of any given section, when the line of the straining force is not in the axis of the material, is in the ratio of $\frac{t}{4t - 6d}$ compared with that of the coincidence of the two as unity, in which d is the distance between the nearest side of the section and the axis or line of the force applied, and t, the thickness of the plate, from which it is evident that the resistance decreases in a much of records extant on boiler explosions. This is more especially the case with regard to wear and tear caused by the direct action of steam unmasked by the effects of the fire, as the barrel and outside fire-box of a locomotive cannot be said to be under the direct action of the heat. Perhaps the vibration of the boiler through the motion on the line may intensify this action, but it is clear that vibration cannot be a primary cause. The majority of the reports are illustrated by careful drawings. Eighteen of the forty boilers gave way at the fire-box—eleven from the crown of the inside fire-box being blown down upon the tube plates; seven from the shells or sides giving way; twenty burst at the barrel; and two may be ascribed to miscellaneous causes, from an originally defective plate, and from running off the line. Leaving out all those which occurred at the fire-box, as the majority of these might be ascribed to other influences than direct pressure, all the twenty explosions of the barrel could be traced either to internal furrows or to cracks, both running parallel with one of the longitudinal joints of one of the rings forming the barrel. All the joints which thus gave way were lap-joints; and the furrows or the cracks (and the former greatly preponderate in number) occur at the edge of the inside over-lap, and therefore, just at the point where the diminution of diameter caused by the lap-joint would be most affected by the pressure of the steam.

"The plate at the channels shows distinct traces of lamination through the cross-bending, and it is probable that plate of a good material will gradually laminate, while inferior metal will crack through in less time. Nor are these furrows found with only lap-joints. Butt-joints, with a strip inside the boiler, and thus destroying the equilibrium of internal pressure, have been found to be attended with similar furrows. Channels of exactly the same character have been observed in locomotive boilers with lap joints, which have exploded in Germany.*

"Similar furrows, again, have been noticed in marine boilers, and in old boilers generally, longitudinal furrows being, of course, about twice as dangerous as those appearing transversely. The smoke-box tube plates of inside cylinder locomotive engines have been

* Organ für die Fortschritte des Eisenbahnwesens. 1861, p. 159.

higher ratio than the area of the section increases; and hence the inadequacy of an increased thickness of plate to obtain a proportionate increase of strength—an objection to which the scarf-welded joint is not liable, as the full strength of the plate is always obtained."

As to Mr. D. K. Clark's having first put forward the explanation that furrows are caused by an alternate buckling of the plate, such an illusion would be dispelled by a perusal of the late Mr. Frederick Braithwaite's paper, "On the Fatigue of Metals," read in 1854, before the Institution of Civil Engineers. This brief explanation, due to Mr. Braithwaite, was adopted by Mr. D. Gooch, in a letter to the Board of Trade, published four years before the issue of Mr. D. K. Clark's book. Similarly, in 1859, Mr. Adamson, of Hyde, discussed these matters of furrowing before the Institution of Mechanical Engineers of Birmingham, as an action well known by engineers to be due to alternate buckling, or, indeed, to anyone who had bent to and fro a piece of wire or of plate.

found to be similarly influenced by the racking action of the engines, showing furrows around the cylinder flanges. A parallel case is often found in Lancashire with the end-plates of double-flued Fairbairn boilers, which may have been too stiffly stayed to the barrel. Circular furrows, caused by the confined motion of the end-plates are sometimes found at the base of the angle iron rings jointing the internal flues to the end-plates. But furrowing seems with no kind of boiler to be more felt than with locomotive boilers. This is due to the high pressure, to the thicker plates causing a coarser lap, and more especially to the fact that the unstayed barrel cannot be thoroughly examined without drawing the tubes, thereby enabling the furrow to enlarge itself unnoticed.

"The inside fibres of a plate bent up while cold are necessarily initially in a state of compression. When the pressure from the inside comes on, striving to form a perfect cylinder, the plate gets bent to and fro by its own elasticity on one side, and by the pressure on the other. If the iron be brittle, it may crack right through; if ductile, the outside fibres gradually lose their elasticity, and, necessarily aided by other causes, crack away. This action is progressive, and probably very rapid towards its later stage. Once a weak place formed itself, it would have to do more and more of the work. Even when pulled by the direct tension of the testing machine, a lap-joint behaves in a somewhat similar way. For instance, a $\frac{1}{2}$-in. lap, solidly welded by Bertram's process, has only half the strength of the solid plate;* while the three-eighths of an inch lap-weld has actually two-thirds of the strength of the solid plate. . . . .

"There is, however, another important appearance to be noted with respect to these furrows. An iron cylindrical vessel under internal pressure would, of course, rupture long before it could assume a spherical shape, from its ranges of elasticity and of ductility being so short. But it may be said to be undergoing three district stresses in as many directions. There is a stress acting on the ends, and tending to rupture the boiler in two halves in a direction parallel to the axis; there is the stress which is hoop tension in a true circle, but which acts with a cross bending strain in an ordinary boiler; and there is the stress which tends to make it assume the shape of a barrel, or to bulge it out in the centre of its length. The precise action on a material of several strains like this is a portion of the strength of materials which is still completely unknown. Its probable effects might be illustrated by the ease with which a stretched india-rubber ring is cut through with a knife, or that with which a column under compression is broken by a blow from a hammer, or by the similar ease with which a tube under tension is split by a sharp blow; in fact, the operation of caulking a defective boiler under steam seems to often give it the finishing stroke which causes an explosion. The new boiler which burst from a defective plate at the Atlas Works, Manchester, in 1858, and that which burst through a crack at a longitudinal joint last January at Peterborough, both gave way whilst being caulked. This again accounts for the fact that adjacent boilers sometimes explode one after the other, pointing, at the same time, to the danger into which a sound boiler may be thrown by an explosion. Upon the same principle it is probable that the modern guns, built up from strained rings, will be easily put *hors de combat* by shot. The probability is that a number of

* "Recent Practice on the Locomotive Engine," p. 5.

simultaneous strains in different directions diminish the elasticity of the material that would allow it to yield in any given direction. However this may be, it will be seen that it is only the pressure on the ends of the boiler acting parallel to the axis, and tending to tear the cylinder through transversely, which bears fairly on the rivetted joint, or rather on that metal between the rivets which is left after punching. Unless the cylinder be perfectly correct inside, the circumferential strain resolves itself into cross bending, shifting the dangerous section from the iron left after punching to the metal at the over-lap. With respect to the stress tending to bulge the cylinder in the centre, it is clear that if we suppose a strip cut out from the entire length of the boiler, each portion of the length of this strip could be regarded as a beam under an uniformly distributed load. As, however, with the lap joint there is a double thickness of metal transversely, that joint is the strongest and stiffest portion to resist the stresses tending to bulge out the cylinder in the middle, and also to tear it into two halves. This affords some justification for the belief of old boiler-makers before rivetted joints were tried under a direct tensional load, that the joints are the strongest parts of the boiler. And, indeed, this is what we find in practice. The thinnest portion of the longitudinal furrows is generally exactly in the middle of the plate, and this is caused by the longitudinal stress, which is acting at right angles to the transverse cross-bending stress. A strip cut from joint to joint is, in one respect, in the condition of a beam supported at both ends, uniformly loaded throughout its length, and, according to known principles, therefore giving way in the middle."

Now, if there be any virtue in words, it is clear that Mr. D. K. Clark simply assimilates the strain on a lap-joint, when made up into a boiler shell, to the tension which it undergoes by means of the straight pull of a testing machine. Amongst other little things forgotten by him is, therefore, the tendency of the imperfectly circular shell to form a correct circle. This does not, correctly speaking, cause what Mr. Clark terms "indirectness of strain," but complete cross-bending. Perhaps Mr. Clark will favour us with an explanation of the fact that butt-joints, with a covering strip inside, and with which, in the testing machine, there can be no "indirectness of strain," also lead to furrowing, while, when the plate is *outside*, no furrowing is found to take place. Mr. D. K. Clark next states, "In addition, my explanation of the destructive action of unequal expansion of the fire-box of locomotives and the shell, upon the stay bolts, in straining them laterally beyond the limits of elasticity, and thus permanently weakening them, was published at the same time [Recent Practice, pp. 16, 17], and, I think, anticipates *all* that Mr. Paget has just written on the same subject." Having been vainly striving to find an application of this assertion, perhaps Mr. D. K. Clark will kindly substantiate it by pointing to the passage in his work. I see, however, that, at page 10, the author proposes to strengthen fire-box stay bars "by straining them beyond the limits of elasticity," an operation which appears to "destroy" stay bolts, though it improves stay bars.

The only information I have borrowed from Mr. D. K. Clark's book on "Recent Practice in the Locomotive Engine" are the results he publishes of the tests conducted by the Admiralty on Bertram's welded joints. This I have acknowledged by a reference.

F. A. PAGET.

18, Adam-street, Adelphi, W.C., 15th May, 1865.

OIL FROM TEA SEED.—SIR,—In the *Journal* of the 21st April, I notice the following extract from the *Englishman*:—"It has lately been an important question among the tea planters what to do with the large quantity of tea-seed now available. It will, therefore, be an interesting fact for them to learn that a trial was recently made at Calcutta to produce oil from tea-seed. The result would seem to prove that three maunds of tea-seed will yield about one maund of oil. This oil is similar in appearance to olive oil." I cannot help feeling a little surprise that the *Englishman* and the tea planters of India should have to learn this "interesting fact" so late in the day—a fact, like many others of more recent western discovery, as old as the hills in the far East. Were some of those gentlemen to put themselves on board a steamer, and take a run round to Hong Kong, they would not only improve their health by a delightful two weeks' trip, but also have the pleasure of discovering for themselves the fact, that in that colony, as in China generally, tea oil is in common use for domestic purposes. In my own household, during my sojourn in that part of the world, I never used any other oil. Tea oil burns with a clear, bright light, and is free from unpleasant odour. This is one more illustration of the adage, that "There is nothing new under the sun." J. B. S.

MEETINGS FOR THE ENSUING WEEK.

MON. ...R. Geographical, 1. Annual Address, "On the Progress of Geography." By Sir R. Murchison, K.C.B.

TUES. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Discussion upon Mr. Fletcher's Paper, "On the Maintenance of Railway Rolling Stock." 2. Sir Charles T. Bright, "The Telegraph to India, and its Extension to Australia and China."
Zoological, 8½.
Ethnological, 4. Annual Meeting.
Royal Inst., 4. Prof. Frankland, "On Organic Chemistry."

WED. ...Society of Arts, 8. Mr. T. M. Gladstone, "On Anchors and Cables; their History, Varieties, and Properties."
Geological, 8. 1. Mr. Joseph Prestwich, F.R.S., "Additional Observations on the Raised Beach of Sangatte, with Reference to the Date of the English Channel, and the Presence of Loess in the Cliff Section." 2. Messrs. Clement le Neve Foster and William Topley, "On the Superficial Deposits of the Valley of the Medway, with remarks on the Denudation of the Weald."
Archæological Assoc., 8½.
Linnæan, 8. Annual Meeting.

THURS...Antiquaries, 8.
Royal Inst., 4. Prof. Frankland, F.R.S., "On Organic Chemistry."

FRI.......Royal Inst., 8. Dr. H. Bence Jones, "On the Determination by the Spectrum Analysis of the Rate of Passage of Crystalloid Substances into and out of the Tissues of the Living Body."

SAT.......R. Botanic, 3¾.
Royal Inst., 4. Mr. Alexander Herschel, "On Meteorology."

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 29th April and 1st May, 1865.*

90. Bills—Merchant Shipping Disputes.
115. " Union of Benefices Act Amendment.
119. " Mortgage Debentures (amended by the Select Committee, and on re-commitment).
120. " Land Debentures (amended by the Select Committee, and on re-commitment).
121. " Land Debentures (Ireland) (amended by the Select Committee, and on re-commitment).
52. (III.) Trade and Navigation Accounts (31st March, 1865).
90. (IV.) Civil Service Estimates (Class IV.).
212. Public Debt—Account.
209. Illicit Distillation (Ireland)—Return.
211. Mails (India, China, and Australia)—Memorial.
217. Bradford (York) and Keightley Unions—Returns.
224. Judges' Lodgings—Return.
226. Rateable Property (Ireland)—Return.
Mr. Cobden—Despatch from M. Drouyn de Lhuys.
122. Bill—Constabulary Force (Ireland) Act Amendment.
203. Parsonage Houses—Return.
207. Fisheries—Account.
216. Wexford Harbour—Returns.

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507 (A X). Poor Rates and Pauperism—Return (A).
123. Bill—Bank Notes Issue (as amended in Committee, and on Re-commitment).
66 (VII). Railway and Canal Bills—Eighth Report from the General Committee.
186. East India (Staff Corps)—Return.
195. Population, &c.—Return.
222. Greenwich Hospital—Paper.
233. Tenure and Improvement of Land (Ireland)—Return.
237. Barracks (Ireland)—Return.
65 (VII). Committee of Selection—Eighth Report.
90. Civil Service Estimates—General Abstract.
205. Poaching Prevention Act (Cases Reported)—Return.
205 (I). Poaching Prevention Act (Expenses of Prosecutions)—Return.
227. Royal Dockyards—Papers.

239. Civil Service Estimates (1865-6)—Abstract showing Grants proposed, the sums voted "on account," and sums required to complete the several Grants.
248. Greenwich Park (South Eastern Railway—Minutes of Proceedings.
Commercial Reports from Her Majesty's Consuls in Japan.
124. Bill—Bank Notes (Ireland).
181. Militia Regiments (Establishment)—Return.
228. Public Income and Expenditure—Account.
231. Azeem Jah (Signatures to Petitions)—Report, Evidence, &c.
245. Exchequer Bonds—Account.
Commercial Reports from Her Majesty's Consuls in China.
113. Bills—Greenwich Hospital.
124. „ Bank Notes (Ireland) (corrected copy).
200. South Eastern of Bengal or Mutlah Railway Company, &c.—Returns.
213. East India (Employment of Officers)—Returns.
223. Inland Revenue (Scotland)—Statements.
225. Belfast College—Returns.
230. Courts of Probate (London and Dublin)—Accounts.
231. Azeem Jah (Signatures to Petitions)—Corrected pages.
236. Foreign Sugar—Account.
238. Emneth Parish—Correspondence.
241. Sheep (Ireland)—Return.
242. Queen's Colleges (Ireland)—Return.
244. Fortifications—Account.
246. Russian Epidemic—Letter.
249. National Portrait Gallery—Eighth Report.
252. Manchester Spring Assizes—Return.
254. Bradford (York) and Keighley Unions—Letters.
3. (301 to 303) Railway and Canal, &c., Bills—Board of Trade Reports, Parts 301 to 303.
Ordnance Survey and Topographical Depot—Report.
Public General Acts—Cap. 1 to 16.
117. Bill—Salmon Fishery Act (1864) Amendment.
3 (304). Railway and Canal, &c., Bills—Board of Trade Report, Part 304.
229. Liabilities (Great Britain and Ireland)—Return.
232. Dale Dyke Reservoir—Reports of the Engineers.
240. Poor Law (Able-bodied Paupers)—Return.
253. Military Reserve Funds—Account.

Patents.

From Commissioners of Patents Journal, May 12th.

GRANTS OF PROVISIONAL PROTECTION.

Animal charcoal, reburning of—1198—T. White.
Artificial arms and hands—1185—W. E. Newton.
Bearings for mechanical purposes—109—F. G. Mulholland and T. Dugard.
Beds and bedsteads, folding—1228—W. E. Newton.
Bottles, removing corks from the interior of—1132—G. Haseltine.
Bread, &c., baking of—1108—J. Y. Betts.
Buttons, manufacture of—1199—G. A. Huddart.
Cartridge cases, charging and closing—1182—R. A. Brooman.
Chain cables, manufacture of—524—J. Shortridge.
Cranes—884—W. Irlam.
Croquet, mallets used in the game of—1181—J. F. Feltham.
Digging machinery—1124—O. C. Evans.
Driving bands, straps, &c., fasteners for—1222—J. F. Alexander and T. F. Cashin.
Drying cloths, portable hot rooms for—1135—W. Williamson.
Dyeing yarns—1193—R. Ferrie, J. Murray, and A. Wilson.
Electric telegraphs—678—H. W. Cook.
Electric telegraphs—960—A. Millar.
Embossing presses—1224—R. Fenner.
Fibrous substances, preparing and spinning—1160—W. Oxley.
File blanks, apparatus for rolling or shaping—1190—E. McNally.
File cutting machines—1172—J. Dodge.
Fire-arms—1207—E. Della-Noce.
Fire-arms, breech-loading—1177—J. Carr.
Fire-escapes—1164—T. D. Whitehead.
Flowers and leaves, arrangement of—1187—T. C. March.
Fluids, apparatus for raising—1191—J. Bernard.
Furnaces—1186—D. Simpson.
Furnaces, smoke-consuming—1152—R. A. Brooman.
Gas-ammonical engines—1074—L. de St. Ceran.
Gas engines—986—P. Hugon.
Gas regulators—1109—F. Wise.
Guns, breech-loading—1197—L. W. Broadwell.
Hydraulic pulling jacks—1176—J. Tangye.
Invalid carriages—1120—H. E. Newton.
Jacks used when roasting and baking—1106—W. Robinson.
Knife cleaning machines—1213—J. C. Davis.
Letter clips, &c., manufacture of—933—T. Corbett and R. Harrington.
Liquids, measuring the flow of—1150—T. Walker.
Liquids, steam, and gases, valves for—1226—T. Russell.
Locks and lock furniture—1194—W. H. Tucker.
Looms, pickers for—1200—G. P. Dodge.
Looms, self-acting temples for—1142—C. and G. Eastwood.
Lubricating frictional surfaces—1175—J. W. Lowther.
Machinery, regulating the power and velocity of—1230—C. W. Siemens.
Mangles—1217—W. Watts and J. J. Cooper.
Marine steam engines—1212—D. Rankin.
Masts, spars, &c., machinery for cutting—1179—S. Harvey.
Metals, compositions for preserving—1154—J. N. Brown and T. D. Clare.
Metals, furnaces for smelting and melting—1183—W. Balk.
Metals, machinery for moulding—1122—R. Canham.
Metal tubes and rods, finishing and polishing—1229—T. Allcock.
Motive power, apparatus for acquiring—1156—C. Jacquelin, jun.
Needle guns, breech-loading—1146—J. F. C. Carle.
Pencils, everpointed—1216—W. E. Wiley.
Penholders, manufacture of—1236—M. H. Beguin.
Petroleum, illuminating apparatus for burning—1237—P. A. le Comte de Fontainemoreau.
Pig iron, manufacture of—1208—H. Bessemer.
Propelling vessels—1215—M. W. Ruthven.
Reducing friable substances to powder—1178—H. W. Wood.
Resinous gum or balsam—1173—G. T. Bousfield.
Revolving shafts, apparatus for receiving the thrust of—1234—E. T. Read and J. B. Fyfe.
Rockets—1103—W. Hale.
Rocks and minerals, excavating and blasting—1192—J. Bernard.
Sewing and embroidering, machinery for—1167—G. Mumby.
Sewing machines, guide applicable to—1047—F. Bapty and E. B. Sayers.
Ships, fastening wooden planking to iron frames in—1162—W. Husband.
Sick or infirm, administering nourishment to the—1140—W. E. Gedge.
Spectacles, opera glasses, &c.—1205—J. Gutmann.
Steam engines, double cylinder—860—J. Rooke.
Tablets, tickets, &c.—1196—C. Gammon.
Textile substances, ascertaining the degree of torsion and resistance in the threads of—1235—P. A. le Comte de Fontainemoreau.
Thrashing machines, fan or exhaust for—1241—W. E. Gedge.
Utilising the heat of steam, apparatus for—854—D. E. Blacke.
Vegetable and animal substances, apparatus for disintegrating—1168—F. D. P. J. Cabasson.
Violet coloring matters, obtaining—1098—E. Smith and C. Sieberg.
Water-closets, indicators and fastenings for—1096—H. K. Taylor.
Waterproof fabrics—1219—W. E. Newton.
Water wheels—1189—A. C. Henderson.
Wood, planing and moulding—143—J. Robinson and J. Smith.
Yarns and threads, bleaching and dyeing—718—L. Gantert.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Fog signals, apparatus for producing—1256—E. Richardson.
Printing types, machinery for setting and distributing—1271—W. Clark.
Regulating distances, engines and tools for—1245—W. F. Stanley.
Textile fabrics, drying and stretching—1233—G. T. Bousfield.

PATENTS SEALED.

2851. C. Vero.
2855. T. Restell.
2862. J. Aubin.
2871. T. Rowatt, jun.
2872. J. H. Johnson.
2874. H. Wilson.
2875. H. Wilson.
2876. A. G. Hunter.
2883. A. A. Croll.
2887. W. Wilson.
2930. G. Brunton.
2960. T. Greenhalgh.
3000. F. C. Reim.
3116. J. Ellis.
361. W. Staats.

From Commissioners of Patents Journal, May 16th.

PATENTS SEALED.

2879. W. Snell.
2882. T. A. Blakely.
2888. J. Petrie.
2899. J. Macintosh and A. H. Thurgar.
2905. S. Bourne.
2910. G. Kottgen.
2918. T. M. Brisbane.
2925. G. Prioleau.
2926. J. S. Gisborne.
2955. C. Hartley and T. Hall.
2968. W. Jackson, and J. and W. Glaholm.
2975. G. Davies.
3043. W. J. Burgess.
3061. A. V. Newton.
3111. P. A. le Comte de Fontaine-moreau.
3231. H. and E. Sutherland.
36. A. V. Newton.
52. E. Tyer.
66. L. Weber.
222. J. H. Pepper and T. W. Tobin.
564. J. Fordred.
614. J. Whitley.
640. H. W. Wimshurst.
672. W. Smith.
776. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1467. J. Dicker.
1406. J. T. Cooke.
1424. H. Cartwright.
1506. F. E. Sickles.
1653. W. E. Newton.
1422. J. H. Johnson.
1432. S. B. Ardrey & S. Beckett.
1440. J. H. Johnson.
1447. W. Southgood.
1450. C. T. Porter.
1455. H. Deacon.
1490. N. Ames.
1498. R. Davison and T. Johnson.
1529. H. B. Barlow.
1884. E. Hunt and H. D. Pochin.
1466. J. P. Jouvin.
1470. J. Stone.
1473. C. Attwood.
1484. A. A. Lamiable.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1035. W. E. Newton.
1665. H. J. Giffard.
1038. R. B. Goldsworthy.
1058. R. Halliwell.
1060. J. M. Gilbert.
1115. J. Bottomley and A. H. Martin.
1090. J. Macintosh.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, MAY 26, 1865. [No. 653. VOL. XIII.

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Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

MAY 31.—*Derby Day.*—NO MEETING.

JUNE 7.—*Extra Meeting.*—"On the Policy of an Amalgamation of the Railways of the United Kingdom, under Government Management." By WILLIAM HAWES, Esq., Chairman of the Council.

CONVERSAZIONE.

The Council have arranged for a Conversazione on Wednesday, the 14th June, at the South Kensington Museum, cards for which will shortly be issued.

INTERNATIONAL EXHIBITION OF 1862.—JURY REPORTS.

The Council beg leave to announce that there are a small number of copies remaining of these Reports, which may now be had on application at the Society's House, price £1 5s. in cloth, or £1 11s. 6d. bound in morocco.

Proceedings of the Society.

TWENTY-FOURTH ORDINARY MEETING.

Wednesday, May 24th, 1865; W. Hawes, Esq., Chairman of Council, in the chair.

The following candidates were proposed for election as members of the Society:—

Hawkins, Henry, Wallingford, Berkshire.
Holroyd, Edward, Church-street, Wimbledon, S.W.
Miller, James Gordon, Financial Insurance Company, 60, King William-street, E.C.
Payne, Wyndham, 32, Kensington-square, W.
Smith, Thomas Roger, 57, Strand, W.C.

The following candidates were balloted for and duly elected members of the Society:—

Homan, Julius, 85, The Grove, Camberwell, S.
Hunt, Alfred Terrett, 1, Encombe-terrace, Wandsworth-road, S.W.

The Secretary called attention to a peculiar kind of slow-burning fuel, described at page 469.

The Paper read was—

ANCHORS AND CABLES; THEIR HISTORY, VARIETIES, AND PROPERTIES.

By THOMAS MURRAY GLADSTONE, C.E., Asso. I.N.A., Engineer to Lloyd's Registry of British and Foreign Shipping.

The ground tackle of ships is a subject of no mean importance, and comes next to the construction of the hull itself. It has had the attentive consideration of the nautical man as well as of the scientific inquirer throughout all ages of history, its improvements commencing with the first dawn of civilisation. When we trace the history of anchors and cables, we can observe the clear advance of human intelligence, and we also cannot fail to find traces therefrom of a retrograde nature among mankind at different epochs. These form certain strongly-divided landmarks, which are made to appear in the course of this investigation. If we take the records of the Chinese, we are given to understand that in the earliest period of their history, from the trading character of their people, anchors and cables (it is true of a primitive character) were known. Though their records can hardly be exactly ascertained as to their approximate dates, yet they show, most decidedly, the antiquity of the use of ground tackle by a people, whole villages of whom live upon the water. Whether the anchors were wood, loaded with stone, or wood, bound together by some metal and weighted, of the crudest form; whether the cables were most rudely put together with the fibres of grasses, or however uncouth and peculiar, they formed the first step in human progression towards the means of navigation. On the other hand we have historical records, both as regards anchors and cables, in the more western world, upon which great reliance can be placed; and as the subject naturally divides itself into two parts, that of the anchor and the cable, as a matter of precedence I will commence by a brief historical account of the anchor.

The anchor being of such vast importance in navigation, from its complicated and weighty character, the want of it must have occasioned the utmost obstruction to the navigator, for it became a necessity on mankind venturing, after constructing larger vessels than canoes, to extend navigation to the coasts. They then found it imperatively needful to have some means that would give security to their ships, when exposed to either a lee-shore or to strong currents. The most ancient consisted of large stones, sacks filled with sand, or logs of wood loaded with lead,

the last of which may even now be seen as used by the Chinese in securing their unwieldy junks. Of this kind was the anchor of the ancient Greeks, which, according to the accounts given by Polonius Rhodius, and Stephen of Byzantium, was made of stone; Athenæus states that they were sometimes made of wood and loaded with stone. It was found that, as these only retained the vessel by their friction on the bottom of the sea combined with their inertia, other contrivances became necessary for the purpose; therefore, as early as iron could be made available, it was introduced for their construction, and then began the grand improvements in forming them with teeth or flukes, by which to fasten themselves in the ground. Thus the words *οδοντες* and *dentes* are frequently applied to anchors by the Greek and Latin poets; but the general term used by the Greeks for anchor is *αγκυρα*, which Vassius thinks is derived from *αγκη*, a hook or crook, an instrument of iron used for holding ships in any situation, by preventing them drifting on to the shore or rocks; this being effected when the anchor is let down from the ship and fixes itself in the ground so as to hold the vessel fast. The invention of the teeth is ascribed by Pliny to the Tuscans, but Pausanias gives the merit to Midas, King of Phrygia. Originally there was only one fluke or tooth, but, shortly after, a second was added, according to Pliny, by Eupalarius, or, according to Strabo, by Anacharsis, the Scythian philosopher. The anchors with two teeth were called *αμφιβολοι*, and from ancient monuments they appear not to be dissimilar to the old Admiralty anchor as used until a very recent period of modern history.

It would appear, therefore, that anchors were generally made of iron through many ages; but in Spain, and in some other parts of the world, when that metal was not available, they were made of copper, and, in the South Seas, of a heavy wood, called "iron wood," from its great specific gravity. Anchors are mentioned in only two places in the Holy Scriptures. The first by St. Paul, when he and his companions were shipwrecked. On fearing they should be cast upon the rocks, "they cast four anchors out of the stern" (Acts xxvii., 30 v.), and in his Epistle to the Hebrews (vi., 19 v.) the same apostle, having no doubt a vivid recollection of his danger, uses it as an illustration when he says, "Which hope we have, as an anchor of the soul, both sure and steadfast." It would appear that, even at this time, vessels had numerous anchors, the largest of which corresponded with what is now denominated the "best bower," or "sheet anchor." This was never used but in extreme danger, and hence was peculiarly termed *ιερα*, or "sacra;" thence the expression "Sacra anchora," as indicating the last refuge. Indeed at this time, for want of a proper instrument, such as I proposed in a paper given in the volume for 1863 of the Transactions of the Society of Naval Architects, along with the drawing which would enable us to know what strain a ship exerts upon her ground tackle in all weathers, we have not attached to every vessel that "sacra anchora" so justly venerated by the ancients.

As the sizes of vessels increased, and the working of iron in large masses was still difficult, it can be readily imagined how costly the anchor must have been; so that through many ages that which is so commonly used in moderate-sized ships of the present day, and so economically manufactured, would have been worth its weight in silver; indeed, would have been thought one of the wonders of the world.

The modern improvements are exemplified in the numerous drawings now before the meeting. The first which connects the ancient with the modern times is the old Admiralty anchor, contrasting which with the new Admiralty anchor, it will be seen what a decided improvement and increased beauty of form is reached. Besides these we have a great variety of anchors, the designs of many inventors. When I note that upwards of 80 patents have been taken out for anchors within the last century, it gives strong evidence that a large amount of ingenuity has been exerted towards attempting to perfect this valuable instrument. Among these I will give a few illustrations from those that best deserve consideration, including those which from their intrinsic merits have become, and are generally used, at this day.

These useful anchors divide themselves into three distinct kinds, each having its peculiar merits, and each having its supporters among nautical men. The first is that which I have alluded to, the "Admiralty anchor," which includes, as a class, all anchors with a "solid cross" or "crown," that is, Mr. Perring's improved Admiralty anchor, Captain Rodger's, Captain Hall's portable anchor, Mr. Cotsell's improved admiralty, Mr. Hutchin's, and other solid crowned anchors. The second is the "pivot" anchor, beginning with Mr. Porter's—Mr. Trotman's, and Mr. Wood's, being of the same class and based upon the same principles. The third is that of Captain Hawkins, of which Mr. Martin's is shown in a great degree to be a modification.

Of the first class it is reasoned, that being of a solid form throughout and less complicated in workmanship, it is, whether as the Admiralty or as Rodgers's anchor, the most reliable for general use. But it is evident that, under one circumstance at least, it has this disadvantage, that as in shallow water the upper fluke of the anchor points upwards from the ground, the vessel is liable to be injured by the anchor piercing her bottom. It will easily be seen that in the anchors of the No. 2 and No. 3 class this liability does not exist. On the other hand it is given as an argument against these other forms of anchors, that in the parts which are jointed they are likely to become fixed by stones or other material of the ground, so as to prevent the arms from taking the proper direction for holding the ship.

Another disadvantage of pivot anchors was said to be that when the ship veered from the direct line of strain in which the anchor lay, it had a tendency to destruction from the arm slipping from off the shank, but this weakness is obviated completely in Mr. Wood's anchor by an indent on the shank, making such liability impossible. It is seen that Capt. Hawkins' and Mr. Martin's anchors hold by both arms, and not as the others, by one only. It would appear that these give all which an anchor requires, yet it has been asserted that these are not perfect, and their holding power not certain when the ship swerves from the straight line, being apt to trip. If these opinions be correct, the perfect anchor has not yet been produced; there is, therefore, a field for inventors to work in not yet exhausted. But it is a satisfaction to note that so great has been the attention and care in the proportions and manufacture of anchors, that a very high condition of security is given in the use of these several valuable descriptions.

To ascertain one great necessity in anchors—that is strength—some test becomes necessary, so as to secure the full results of these qualities according to their character and design. This test is by tensile strain, the mode of applying which I will describe further on.

The following table gives the tensile strain of the three most distinguished anchors, and sets forth their extreme value:—

On the Relative Powers of Three Kinds of Anchors as Tested by a Special Committee in 1851.

	cwt.	qr.	lb.	Admiralty Proof. Tons.	Cracked at Tons.	Broke at Tons.
Admiralty ...	20	2	0	... $21\frac{15}{20}$	... 48	... $56\frac{19}{20}$
Rodgers	19	0	8	... $19\frac{19}{20}$	... 45	... $73\frac{19}{20}$
Trotman's ...	21	1	10	... $21\frac{17}{20}$	... $51\frac{18}{20}$	... $53\frac{5}{20}$

Showing Rodgers up to final separation $270\frac{1}{3}$ per cent. beyond Admiralty test; Trotman's ditto, $143\frac{3}{4}$ ditto; Admiralty ditto, 160 ditto; although Trotman's exceeds the others up to the point of an appearance of weakness.

I now proceed to examine the other branch of this interesting subject, namely—cables. This can be distinctly separated into two parts, the one class being

made from fibrous and vegetable substances, the other being made of metal. For a given period, up to the commencement of the present century, the former was the sole substance of which the cable was made. This was chiefly the direction in which Russian hemp was largely consumed, as, from the smallest line of the thickness of a quill to the largest cable, sometimes even 26 inches in circumference, it was used; but, like all vegetable substances, it was subject to decay. Coir rope also began to be used. Tar was employed to help its preservation, yet its duration was very limited; besides, it was readily chafed by harder matter, so that it became a constant employment for the seamen to save the rope by gaskins, whether at its attachment to the anchor, the pressure at the hawspipe, at the windlass, or elsewhere, which abrasion added not a little to the cost of maintenance with relation to the general charge of the ship. For warping, and for other purposes where comparative lightness is desirable, ropes composed of these substances are still in use, but the disadvantages of rope in the form of a cable for holding the ship were found to be very great; its great bulk, its rapid deterioration from the action of damp, its liability, in despite of every precaution, to be abraded on rocky ground, its certainty of being cut in a tideway by the action of ice, and its greater cost compared with the iron cable, even at extravagant prices—these were more than equal to the advantages arising from its greater elasticity and lightness, so that, for 30 years past, rope cables have been quite superseded by those made of iron.

When first I considered this subject with relation to the second part, that is "iron cables," I believed these to be an invention within my own lifetime, but on looking into the Patent-office, I found that in 1606 there was a patent taken out for chains, the terms of which were very quaint, but practically clear. I thought this was going a great way back, but searching further I found, from an old manuscript in the British Museum (a most valuable and highly illuminated work), that in the 14th century chains were used on board ship instead of hemp. Nor can the fact be questioned, as in a drawing in the same M.S. the ships are moored to the beach by chains, the links themselves being shown. But searching still further—in Cæsar's account of his Gallic wars, about 57 years before the Christian era, these remarkable observations are made by that conqueror, when writing of the Veneti of Brittany. "These people," he says, "trading with the Ancient Britons, called Belgæ, (who inhabited that portion of England which would include Somersetshire, Cornwall, Devon, and all the south-west of England and Wales) used cables made of iron instead of rope." Now, this singular fact, emanating from so old and excellent an authority, suggests many reflections as to what must have been the condition of the iron manufacture here, and shows it to have been one of the early productions of Great Britain. It points out that nearly 2,000 years ago, in addition to copper, tin, lead, and other metals for which the Phœnicians and other eastern nations traded with Great Britain, the most intrinsically valuable of all of these metals, iron, must have constituted an important item of the industry of the people, and almost makes us think that there must have been a considerable amount of practical mechanical knowledge diffused among the people. The term barbarian must, therefore, be taken in a very modified sense when used by their invaders and conquerors, the Romans, on being applied to the people of Great Britain.

Iron cables were re-introduced early in the present century, and in 1808 Lieutenant Brown, afterwards Admiral, became actively engaged in developing the use and advantages to be derived from them. At the same time, if not earlier, Mr. Robt. Flinn, of North Shields, seems to have been promoting their manufacture, and the following advertisement given in the *Newcastle Courant* of that year, proves his enterprising spirit:—"Notice to Ship-owners. Robt. Flinn, black and whitesmith, North Shields, respectfully acquaints shipowners and the public that at this period, when hemp can scarcely be procured, he manufactures chain hawsers for ships, of any length or size. The ship *Ann and Isabella*, Mr. Donkin owner, was the first to make trial of a chain hawser, when it was found to answer exceedingly well, both as a bower in Shields harbour, and as a mooring junk in the Pool." My informant also remembers hearing the story that in this year, when the ice cut all the ships in Shields harbour adrift, the *Ann and Isabella*, being moored with a chain hawser, was the only one that rode in the stream safely, so that after that a great demand sprung up for chain hawsers or cables.

According to the account of Mrs. Fawcus, the daughter of Mr. Flinn, Lieutenant Brown got the idea from her father for making cables and hawsers of chain, and on his trying to prevent Mr. Flinn from making chain cables and hawsers, the issue proved that the latter had made them before the former.

It is curious to observe the prices which prevailed on this introduction of iron cables, being no less than 74s. 8d. per cwt., when better proportioned chains of the best material are obtained at this time at 15s. per cwt., or one-fifth of the former cost.

The scarcity of hemp which is noted in the above advertisement was occasioned by that great attempt made by Napoleon I. and the Emperor Alexander of Russia, by a compact between them to exclude all the products of the Continent from entering into Great Britain, the products of Great Britain to be also excluded from the continent of Europe. But this could not be permanent, and was of short duration, though tried by these two mighty autocrats, while even such an attempt at the subversion of the free interchange of commodities, no doubt contributed to the introduction of chain cables by increasing the price of hemp, and thereby stimulated our iron industry, the manufacture of iron being at a low ebb in this country at this time, both in quantity and quality. As proof of this, even within my recollection it was considered necessary to use foreign iron to a considerable extent in the manufacture of anchors, from the indifferent quality of English iron. For any iron work that required great manipulation foreign iron was almost solely used. As an illustration of the backwardness of that now most prominent and important production of native industry, it was subsequently to the year 1820 that even hoops were made of English iron. Previously the iron was imported for this purpose from Sweden or Russia in bars, and converted into hoop iron at several water mills situate on the tributaries to the River Thames.

Such being the difficulties, the early manufacturers of chain cables must either have had the iron specially made for them, which is most likely, or their manufacture of chains must have been very inferior and not dissimilar to many that have been manufactured of late years, the last so indifferent as to have demanded legislation thereon.

It appears that the ordinary chains first made were close links, but shortly patents were taken out for twisted and stud links. The twisted link soon passed away, and the short and stud link remain to the present time as the two conditions in the manufacture of iron cables. The action of the stud was to prevent the collapsing of the sides of the links, to which a chain has a tendency at extreme pressures; therefore, the stud link is commonly used for cables. The ultimate actual strength of the two is found to nearly assimilate, and I am almost inclined to doubt whether the short link should not be preferred for cables, seeing that if, by any extraordinary pressure, any portion of the links should be found to have become rigid from their collapse, the chain would be considered unfit for future use, while in the stud link, although it might have been subjected to an undue strain, no such deterioration could be detected.

Contrasted with ropes, the chain has many advantages. By its weight it aids its holding powers; by its weight it compensates for its want of elasticity; by its weight it assists as ballast, and its want of bulk affords increased

LLOYD'S TABLE, No. 22.—MINIMUM WEIGHTS (EX. STOCK) OF ANCHORS OF UNOBJECTIONABLE FORM AND PROPORTIONS; SIZES AND LENGTHS OF CHAIN CABLES; AND THE PROOF STRAIN TO WHICH THEY ARE TO BE TESTED; AND THE SIZES AND LENGTHS OF HAWSERS AND WARPS.

SHIP'S TONNAGE.	ANCHORS.								STUD-CHAIN CABLES.†			HAWSERS AND WARPS.					SHIP'S TONNAGE.
	Number.			Weight.													
				Bowers.*		Including Stock.						Stream.					
	Bowers.	Stream.	Kedges.	Ex. Stock.	Admiralty Test.	Stream.	Kedge.	Second Kedge.	Minimum Size.	Proved to Admiralty Test.	Length.	Chain.	Rope.	Hawser.	Warp.	Length.	
tons.				cwts.	tons.	cwts.	cwts.	cwts.	inch.‡	tons.	fathoms.		inch.	inch.	inch.	The length of them to be 90 fathoms each.	tons.
50	2	1	1	$2\frac{1}{4}$	$4\frac{7}{10}$	1	$\frac{1}{2}$	...	$\frac{11}{16}$	$8\frac{1}{2}$	120	$\frac{7}{16}$	5	3	...		50
75	2	1	1	$2\frac{3}{4}$	$5\frac{2}{10}$	$1\frac{1}{2}$	$\frac{3}{4}$	...	$\frac{12}{16}$	$10\frac{1}{10}$	120	$\frac{7}{16}$	5	3	...		75
100	2	1	1	4	$6\frac{4}{10}$	$1\frac{3}{4}$	1	...	$\frac{13}{16}$	$11\frac{9}{10}$	150	$\frac{8}{16}$	$5\frac{1}{2}$	3	...		100
125	2	1	1	$5\frac{1}{4}$	$7\frac{6}{10}$	2	1	...	$\frac{14}{16}$	$13\frac{3}{4}$	180	$\frac{8}{16}$	$5\frac{1}{2}$	$3\frac{1}{2}$	...		125
150	2	1	1	6	$8\frac{2}{10}$	$2\frac{1}{2}$	$1\frac{1}{4}$	...	$\frac{15}{16}$	$15\frac{3}{4}$	180	$\frac{9}{16}$	6	4	...		150
175	2	1	1	$7\frac{1}{4}$	$9\frac{5}{10}$	$2\frac{3}{4}$	$1\frac{1}{4}$	...	1	18	180	$\frac{9}{16}$	6	4	...		175
200	3	1	1	$8\frac{1}{4}$	$10\frac{4}{10}$	3	$1\frac{1}{2}$	...	$1\frac{1}{16}$	$20\frac{3}{10}$	180	$\frac{10}{16}$	$6\frac{1}{2}$	4	...		200
250	3	1	2	10	12	$4\frac{3}{4}$	$2\frac{1}{4}$	1	$1\frac{2}{16}$	$22\frac{3}{4}$	210	$\frac{10}{16}$	7	5	...		250
300	3	1	2	12	$13\frac{9}{10}$	5	$2\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{16}$	$25\frac{1}{2}$	210	$\frac{11}{16}$	$7\frac{1}{2}$	$5\frac{1}{2}$	...		300
350	3	1	2	$13\frac{1}{2}$	$15\frac{2}{10}$	6	3	$1\frac{1}{2}$	$1\frac{4}{16}$	$28\frac{1}{10}$	240	$\frac{11}{16}$	$7\frac{1}{2}$	$5\frac{1}{2}$	...		350
400	3	1	2	$15\frac{1}{4}$	$16\frac{7}{10}$	$6\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{5}{16}$	31	240	$\frac{12}{16}$	8	6	...		400
450	3	1	2	$16\frac{3}{4}$	18	7	$3\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{6}{16}$	34	270	$\frac{12}{16}$	$8\frac{1}{2}$	$6\frac{1}{2}$	...		450
500	3	1	2	18	19	8	4	2	$1\frac{7}{16}$	$37\frac{2}{10}$	270	$\frac{13}{16}$	9	7	...		500
600	3	1	2	21	$21\frac{6}{10}$	9	$4\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{8}{16}$	$40\frac{1}{2}$	270	$\frac{13}{16}$	$9\frac{1}{2}$	7	4		600
700	3	1	2	$23\frac{1}{2}$	$23\frac{5}{10}$	10	5	$2\frac{1}{2}$	$1\frac{9}{16}$	44	300	$\frac{14}{16}$	10	8	5		700
800	3	1	2	$25\frac{1}{2}$	$25\frac{2}{10}$	$10\frac{1}{2}$	$5\frac{1}{4}$	$2\frac{3}{4}$	$1\frac{10}{16}$	$47\frac{1}{2}$	300	$\frac{14}{16}$	10	8	5		800
900	3	1	2	$27\frac{3}{4}$	$26\frac{9}{10}$	11	$5\frac{1}{2}$	$2\frac{3}{4}$	$1\frac{11}{16}$	$51\frac{2}{10}$	300	$\frac{15}{16}$	10	9	$5\frac{1}{2}$		900
1,000	3	1	2	30	$28\frac{6}{10}$	12	6	3	$1\frac{12}{16}$	$55\frac{1}{10}$	300	$\frac{15}{16}$	10	9	$5\frac{1}{2}$		1,000
1,200	3	1	2	32	$30\frac{1}{10}$	13	$6\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{13}{16}$	$59\frac{1}{10}$	300	1	10	$9\frac{1}{2}$	6		1,200
1,400	3	1	2	34	$31\frac{6}{10}$	$13\frac{1}{2}$	$6\frac{3}{4}$	$3\frac{1}{4}$	$1\frac{14}{16}$	$63\frac{1}{4}$	300	1	10	10	6		1,400
1,600	3	1	2	$36\frac{1}{2}$	$33\frac{4}{10}$	14	7	$3\frac{1}{2}$	$1\frac{15}{16}$	$67\frac{1}{2}$	300	$1\frac{1}{16}$	11	$10\frac{1}{2}$	$6\frac{1}{2}$		1,600
1,800	3	1	2	38	$34\frac{5}{10}$	$14\frac{1}{2}$	$7\frac{1}{4}$	$3\frac{1}{2}$	2	72	300	$1\frac{1}{16}$	11	11	7		1,800
2,000	4	1	2	40	$35\frac{7}{10}$	15	$7\frac{1}{2}$	$3\frac{3}{4}$	$2\frac{1}{16}$	$76\frac{1}{2}$	300	$1\frac{2}{16}$	11	11	7		2,000
2,500	4	1	2	42	$37\frac{1}{10}$	17	$8\frac{1}{2}$	$4\frac{1}{4}$	$2\frac{1}{8}$	$81\frac{3}{10}$	330	$1\frac{2}{16}$	12	12	8		2,500
3,000	4	1	2	45	$39\frac{2}{10}$	19	$9\frac{1}{2}$	$4\frac{3}{4}$	$2\frac{1}{4}$	$91\frac{1}{10}$	360	$1\frac{3}{16}$	12	12	8		3,000

MEM.—For Steamers the Anchors and Cables will not be required to exceed in weight and length those of a sailing vessel of two-thirds their tonnage.

* Two of the Bower Anchors must not be less than the weight set forth above, but in the third a reduction of 15 per cent. will be allowed. All Anchor Stocks must be of acknowledged and approved description.

† Unstudded close-link Chains of one inch in diameter and under, will be admitted as Cables, if proved to two-thirds the Test required for Stud-Chains; but in all such cases a short length, not less than twelve links, must be tested up to the full strain for Stud-link Chains.

‡ Persons desirous of using or supplying Chains of a smaller size, and who are willing to submit them to a greater strain than set forth above, may submit their propositions to the Committee.

space on board ship. Its durability is also great, and, with care and proper usage, it will exceed the life-time of any ship.

From the great improvements that have taken place in the manufacture of iron, from the increased skill of the workmen, and from the great attention which experience has tended to give to its manufacture, we have reached a condition with regard to chain cables, when made in the best way, which is all that can be desired, and the proportion of Lloyd's table No. 22 I think affords a very large amount of security for life and property on shipboard, if all these points are attended to.

As quality, however, is of every importance, both in the anchor and the cable, it was found necessary to legislate thereon, in consequence of bad manufacture (cheapness, not quality) ruling; and last year Mr. Laird, the member for Birkenhead, carried his Bill for the "Testing of Chain Cables and Anchors," which Bill comes into effect on the 1st of July next. This is a step in the right direction, while already Lloyd's Committee of Registry had determined not to give the Class A 1 to any vessel whose cables and anchors had not been tested at a public machine approved by them, and also in sizes, lengths, and proportions, in accordance with their table No. 22. Independent, therefore, of public legislation, besides the public machines at Liverpool, by the activity of Lloyd's Committee, there have been established and are being constructed more than a dozen public testing machines in different parts of the country, and all that are completed are doing excellent service. The scale adopted for the test is that known as the Admiralty scale of proof, and Lloyd's rule is that all cables and anchors must pass such test in a satisfactory manner. As it is necessary to have proper machinery for passing this ordeal, several modes have been adopted for putting on the necessary strain, either by compound wheels, the worm and wheel, or by hydraulic force. From its simplicity, reduced friction, and economic character, the hydraulic power prevails. This power, so valuable for heavy pressures, and so reliable and controllable, has become one of the most important assistants to the engineer, so much so that without it many works of the present day could never have been accomplished.

I recollect, in the year 1850, when standing on the top of one of the tubes of the railway bridge at Conway, North Wales, the weight of which was somewhere about 600 tons, in conversation with the late lamented Mr. Robert Stephenson and Capt. Moorsom, and when the tube

was being lifted equally at both ends at the speed of three feet in one hour by this marvellous hydraulic force, it was remarked—how wonderful, how true, and how controllable was the hydraulic press, and how exactly to be measured by the graduated steel yard.

At any time, with a note from your excellent secretary or other officer of the Society of Arts, I should be happy to show to any of the members the operations at Lloyd's testing-house, Poplar, as the proving of anchors and chain cables proceeds daily at that establishment, and has done so for the last two years and a half under my superintendence; the simplicity, exactness, and rapidity with which the process is carried on would, I think, be fully apparent, and, indeed, to the scientific inquirer, would be found to be exceedingly interesting.

As my time is limited, I have thought it better not to enter into further details in one paper, but I shall hope to have the opportunity for doing so on some future occasion, when many material points can be examined which I have not now ventured to touch upon.

In conclusion I append Lloyd's table No. 22, containing the Nos. and weights of anchors for vessels from 50 to 3,000 tons, also the sizes, tests, lengths of chain cables, hawsers, and warps required, the compliance with which is necessary to give the shipowner the A 1 class for his vessel.

DISCUSSION.

Mr. F. A. PAGET said, having given some attention to at least one branch of Mr. Gladstone's subject, perhaps he might be allowed to make a few observations. Mr. Gladstone had alluded to an instrument, proposed by him, for measuring the strain on chain cables. Having carefully examined his plan, he (Mr. Paget) regretted to state that it was defective in every respect. This was the case quite apart from any difficulties as to the application of the proposed instrument. In the first place, it was unprovided with any means for allowing for the friction of its two leather packings. But even disregarding this shortcoming, it lacked the most important requirement of any common dynamometer. What was demanded in an instrument of this kind, was—according to known principles—in this special case, a record of the work done on the cable by the surge of the vessel. Such a dynamometer ought to be able to record at once the force, the motion, and therefore the work. Mr. Gladstone's proposed instrument no more indicated this than was the work done by a steam engine recorded by the steam gauge. What was required was, in fact, the use of an instrument similar in principle to the ordinary steam engine indicator. A band of paper ought to be moved at right angles to the direction of the pull on the cable, and with a velocity of a known constant proportion. This could, in fact, be done by applying an indicator on Bourdon's principle, and leaving the marks of its pencil on a card worked either by the operator, or by means of wheel work, or even in some cases by the sea. Adapted to a cylinder with a piston pressing on a volume of water enclosed in an elastic diaphragm, it was probable that such an instrument would lead to very useful deductions. Mr. Perkins had, it was stated, used very successfully an indicator of this kind, made by M. Bourdon. There was another point on which he regretted to differ from Mr. Gladstone. He had spoken of the exactness with which the process of testing chain cables was carried on at his establishment. The Board of Trade did him (Mr. Paget) the honour, yesterday, while again requesting him to report on the whole question, to communicate that Mr. Gladstone had now adopted levers and dead weight to his machine, and also that he now no longer preferred to test chains and anchors after being blacked. Mr. Gladstone, however, still appeared to think that it was correct to test 75 fathoms at a time. Admitting that there was a difference in the stress at different parts of the length, Mr. Gladstone thought that all irregularity was obviated by the use of the rollers fixed underneath the cable. But he would ask him whether the roller which would touch and thus support a $2\frac{1}{4}$-inch chain, would also do this for an inch chain? With respect to the supposed proofs Mr. Gladstone had adduced to support his views, it was to be observed that the resistance of iron varied so much that it was only by means of averages, deduced from a very great number of experiments, that the influence of the weight of the cable itself on the test would be apparent. It was an universally acknowledged fact, that any deduction of the kind could only be formed upon a very great number of data. Kinks were also more easily formed in long lengths, and Mr. Gladstone had himself confessed to a case in which "a link pressed crossways against one of the rollers."

Mr. GREEN deprecated the introduction into the discussion of matters not within the scope of the paper, a course which, he said, had been taken by the gentleman who had just sat down.

The CHAIRMAN said it might, perhaps, be doubtful whether the subject referred to by Mr. Paget was strictly within the scope of the discussion, but he always thought it better to allow a certain latitude.

Mr. PAGET submitted that his remarks applied to two distinct subjects introduced in the paper, viz., the principle of testing chain cables, and the special machinery employed by Mr. Gladstone for that operation.

Mr. ROBERT DAVISON thought the objection made to the remarks of Mr. Paget a very proper one, a passing allusion only having been made in the paper to the testing machine employed by Mr. Gladstone. He had seen that machine in operation, and was fully satisfied with its working. He was at a loss to know on what grounds opinions so adverse to that machine could be formed.

Mr. ROCHUSSEN regretted that the subject of the materials of which anchors and cables were formed had not received a more extended notice in Mr. Gladstone's paper. In ship-building it was well known that steel was gradually making way, and it would, no doubt, also be ultimately used for anchors, if not for chain cables, from its greater tensile strength than iron. The standing objection at present against the use of steel was its expense, and the enhanced cost of workmanship as compared with iron, particularly in cases where great accuracy of fitting was required. This, however, was not the case with anchors, which could, therefore, be produced in steel at a comparatively moderate rate. The application of cast steel to the manufacture of chain cables was practically impossible, owing to its unweldable properties, and, therefore, they must fall back upon soft puddled steel. It was a fact much to be regretted that the English workman appeared to have a great aversion to the manipulation of steel. It was therefore to be expected that he would interpose all the difficulties he could in the way of welding the modifications of steel which modern science had introduced into our manufactures. The puddled steel to which he alluded was proved to possess a tensile strength double that of iron. Taking the price of iron for these purposes at £8 per ton, steel of the same dimensions could be obtained at from £15 to £16 per ton; adding to that the cost of workmanship, taking into account a little loss at first, they might have steel anchors and cables at about £25 per ton. That being the case, looking to the important functions that were performed by anchors and cables, he put it to the meeting whether we were justified in using a material for these purposes which would bear a tensile strain of only twenty tons to the square inch, when there was another material at hand which was capable of sustaining a tensile strain of forty tons to the square inch; and while railway travellers were protected, in being drawn up inclined planes, by a material equal to a strain of 60 to 65 tons to the square inch, the lives of our seamen were only guarded by a material the resistance of which rarely exceeded twenty tons to the square inch. He believed shipowners, as a rule, were satisfied if they received from the builder a vessel and its fittings which barely fulfilled

the conditions of the class which it represented, and he feared unless the public took up this question of anchors and cables for themselves, that neither under Lloyd's rules nor any other regulations would they have the largest amount of protection that could be afforded in maritime communication.

Mr. Lenox said that in a paper which he read before the Institute of Naval Architects* he had given the history of chain cable manufacture as nearly as possible as it now stood, and he endeavoured to point out the reasons why chain cables, generally speaking, were most disreputable productions. A little liberality and encouragement on the part of the shipowner were required in order to place this branch of production upon the same scale of excellence as other manufactures in this country. With regard to anchors it was pretty well known that they had been a subject of investigation by a great number of ingenious gentlemen, who each imagined that their own form of anchor was the best; but for his own part he believed that no great advance had been made in this direction since the introduction of what was known as the Admiralty anchor. He gathered from the paper that Mr. Gladstone regarded the Trotman anchor as carrying off the palm from all others. [Mr. Gladstone said he only enumerated that anchor amongst others.] The table given by Mr. Gladstone showed the results of the well-known Anchor Committee of the Government, but knowing as he did the manner in which their trials were conducted, he had no confidence in the results they arrived at. Mr. Lenox entered into a somewhat lengthened history with regard to various forms of anchors from the year 1820, tracing the subject up to the period of the introduction of the Admiralty anchor, the merits of which he claimed for the firm with which he was connected. Up to that period, he submitted, the anchors in use, both in the navy and mercantile marine, were not of a reliable character, either in form or manufacture. They were originally confided by the Government to contractors, who, in some cases, made them so badly that there was scarcely any union between the arms and the shank. These anchors lasted as long as the elastic material, hemp, was employed for cables, but with chain cables they were found to be all but useless. He had known a ship go out with eight or nine of these anchors, and on her return, after three years, she had scarcely a sound one left. A quantity of those anchors were handed over to him by the Government to be altered, and, if possible, made serviceable. Those which were moderately sound, after he took them in hand, stood the proof, but wherever there was a flaw in the crown, which was the most important part of an anchor, the expense of the alteration was greater than it was worth while to incur. Mr. Lenox passed on to remark upon the anchor known as Rodgers', which, he said, appeared very soon after the introduction of the Admiralty anchor. The trials of the model of this anchor made at the Exhibition of 1851 were, in his opinion, most fallacious. For his own part, he liked the first form of the Rodgers' anchor better than the second, and the second better than the third, although it was asserted that the last was capable of standing any proof that could reasonably be applied to it. He would ask where was the use of having anchors four or five times as strong as the chain cable that was to be attached to them? They wanted an anchor only a little stronger than the cable, and he therefore agreed with Mr. Gladstone that the field was still open for further improvements in this direction. Mr. Lenox then adverted to the difficulties which were experienced in the manufacture both of anchors and chain cables until testing machinery was introduced. The machine for that purpose on his own premises, he said, was the joint production of Mr. Rennie (father of Sir John Rennie) and Mr. Walker, a talented machinist who acted as his foreman, and that machine he had in use at the present time. It had been employed in the testing of iron of all kinds. The character of that machine was such that the Board of Trade had decided to license it for testing under the provisions of the late Act of Parliament. He submitted that Lloyd's proving apparatus had yet to receive this sanction; whether they would have the good judgment to make it answer the requirements of the Act of Parliament he could not say. He concluded by remarking, that as long as he remained a manufacturer of anchors and cables it would always be his earnest desire to furnish that which could be thoroughly relied upon.

Mr. Trotman vindicated the claims of his form of anchor. It had, he said, been approved by an independent committee appointed by the Admiralty to test its merits, and upon its merits he was content to let it stand or fall. He was ready at any time to meet the Committee of Lloyd's with facts, and he challenged the investigation of the scientific world on the subject of his anchor.

Mr. C. F. T. Young remarked that notwithstanding the condemnation which had been passed by Mr. Lenox upon Trotman's anchor, he understood that gentleman was at the present time making a number of them for the Admiralty; and it was a curious fact that if those anchors were so bad the Queen's yacht was provided with them. With regard to the Martin and Hawkins' anchors, they appeared to be very much of the type of a hundred years back. On the subject of testing he would say he believed there were grave objections to Lloyd's machine, and that it gave fallacious results. He considered that the safety of our marine demanded the most stringent rules on the subject of the testing of anchors and chain cables.

Capt. Rodgers, R.N., said with regard to the experiments with his anchor at the Exhibition of 1851, they must speak for themselves. Mr. Lenox should have stated the weights respectively of the models experimented upon. The model of the Admiralty anchor weighed 24 lbs., including the stock, while that of his own anchor weighed only 18 lbs., also including the stock, and that difference of 6 lbs., put into cwts., amounted to something considerable. He had devoted a long life to the study of anchors, theoretically and practically, and his first patent was dated in 1819. He admitted that was a total failure. He had now reached his seventh, and he hoped his last patent. He scarcely knew anything which was really so little understood as an anchor. He had rarely met a man who did understand the principle of the anchor, and it was only after fifteen years unremitting study of the subject that he believed he understood it himself, and even now he was not quite sure he did so. He had lately ascertained that three manufacturers in the north, who were licensed for his patent, had made no fewer than 12,200 of his anchors in the last three years. Having detailed the experiments made with his kedge and bower anchors in competition with the Admiralty pattern, Capt. Rodgers, in conclusion, remarked that he had hoped to have heard a criticism upon the properties of the different forms of anchor rather than a history of their introduction.

Mr. Thomas Gray said, Mr. Gladstone had evidently given this subject great consideration, and had written a very clear paper upon it, for which he personally felt much indebted to him. The discussion, however, had somewhat diverged from the original purpose of the paper. Mr. Lenox had favoured them with a chronological history of patent anchors from the earliest times. He had also explained clearly the various alterations effected from time to time in the Admiralty anchor, of which, in its present form, he thought so highly; and had then gone on to show that his testing machinery was, in his own opinion, better than others. It was on this subject that he (Mr. Gray) wished to say a few words. Mr. Paget had to-night taken exception to the testing in lengths of 75 fathoms, which seemed to be the capacity of the

* Trans. Inst. Naval Architects, Vol. i., p. 160.

machine at Poplar, designed (as both Mr. Gladstone and Mr. Dunn had informed him) by Mr. Gladstone himself, manufactured by Mr. Thos. Dunn, of Manchester, and now known as Lloyd's testing machine at Poplar. Now he would say that that machine was almost universally condemned by anchor and cable makers in the country; and that was the machine they were invited to inspect as a model for the simplicity, exactness, and rapidity with which the work was executed. The peculiar claims alleged in behalf of this machine were that it tested in 75 fathoms lengths instead of 15 fathoms, that it did the work in less time than other machines, and did it better. But, unfortunately (if it did so), anchor and cable makers generally had no confidence in it; whether they were right or wrong in this it was not for him (Mr. Gray) to say. In the testing of 75 fathoms length Mr. Gladstone's rule was that the tensile strain itself with the tapping of the hammer was a sufficient testing. [Mr. Gladstone—No, no.] If he were wrong he would rely on Mr. Gladstone to set him right. At all events, the main testing was by tensile strain alone. The test insisted on at Birkenhead and at other public machines of reputation was a tensile strain applied to 15 fathoms lengths, and a subsequent searching examination of each link by two pairs of eyes. The testing strain was applied at Birkenhead before the chain was "blacked," whereas Mr. Gladstone tested "blacked" chains. This was objectionable, as the heat evolved by the strain might cause, and in many cases did cause, the blacking to fill up a flaw in the iron and render it imperceptible. In the next place the machine at Poplar relied mainly upon its hydraulic cylinder, and connected with that cylinder there was a plunger which communicated with a graduated lever for indicating the pressure in the cylinder; but it had been held by the most competent authorities, and could not be controverted, that that was not a correct method of indicating the strain put upon the chain; whether it indicated the exact pressure in the cylinder was indeed an open question. What he most congratulated Mr. Gladstone on this evening was, that he had to some extent apparently seen the error of his ways, by having the lever apparatus added to his machine, so as to put it as nearly as possible on a par with Mr. Lenox's machine, the chief difference being, that Mr. Gladstone's tested in 75 fathoms lengths and Mr. Lenox's in only 15 fathoms. Mr. Gladstone having come over so far, might, he hoped, go yet further, and, when he saw the necessity for it, would probably reduce his machine to 15 fathoms. He hoped that should he have the gratification of hearing Mr. Gladstone read his next paper, after making further alterations in his proving house, he should have the pleasure of agreeing with him, instead of—as he now had the pain of—differing from him.

Mr. Gladstone, in reply upon the discussion, said he could assure the meeting it gave him great satisfaction that he had had an opportunity of listening to the opinions of various gentlemen on this subject, so that if he was wrong he might be set right. He did not, however, admit that he was wrong, and, as his views had been shown to be correct by disinterested engineers of high standing, he must hope that he should have the gratification of hearing from Mr. Gray next time they met a confession of the error of his ways, and an admission that he (Mr. Gladstone) was right. He quite understood the point that was raised by Mr. Paget's opening remarks, viz., that he had seen reason not to trust to the hydraulic machine as a sure indicator of power. He confessed he had heard Mr. Gray's criticism of the machine in question with some amazement, for though it was true that gentleman and Mr. Galloway came to see the machine at Poplar, they neither took any account of the dimensions of the parts, nor carefully ascertained its operation; and the plunger—that was a small piston—spoken of by Mr. Gray, was not on the top of the hydraulic cylinder at all, but many feet removed from it. It had been stated that this was a machine of his (Mr. Gladstone's) own designing, but it was made by Mr. Dunn, whose plans he approved of as Lloyd's engineer, and it was his office to see that the work was done well; he pointed out, however, what he thought would be an improvement, viz., the extending the test from 15 fathoms to a greater distance. Differences of opinion seemed to have recently arisen as to this machine, judging by a report sent to the Board of Trade, "that the ordinary mode of measuring by the hydraulic lever is liable to great variations from circumstances entirely beyond the control of the person working the machine, therefore not to be relied upon." The machine was represented as being inaccurate; it was also stated that the process and principle that he adopted was wrong, viz., that instead of being confined to testing fifteen fathoms, which had never been exceeded up to that time, at Lloyd's machine they were enabled to prove all intermediate lengths up to seventy-five fathoms, and the following curious statement was made that, when a 15 fathoms length was tested the chain was stretched perfectly tight like a string on a violin, but in the 75 fathoms length the chain was never pulled out of the form of a curve, or rather a series of curves or festoons. It was still more curious, that those who made this report should never have measured the deflection in a single 15 fathoms of chain when under test alone, and also measured the deflection when more lengths than one 15 fathoms were under test, as, had they done so, they would have found no difference whatever between any one of the 15 fathoms at the Admiralty proof. In order to prove that the extended length could be equally well used, at Lloyd's machine there were placed powerful levers, with knife edges, constructed by the eminent firm of Messrs. Maudslay, Sons, and Field, in such a manner as to apply them either at 15 fathoms lengths, or at the more extended lengths, when they were found to coincide with the hydraulic lever in both situations simultaneously. When several lengths of large chain were at the Admiralty test, the deflections between each fifteen fathoms were carefully measured by Mr. Field and Mr. Crosland, and they were found all equal, each deflection being 1½ inch only, or 3 in 2,160 inches; therefore, how it was conceived that they hung in a series of curves or festoons he could not possibly imagine. Certain other experiments were made which proved most completely that whether at fifteen, thirty, forty-five, sixty, or seventy-five fathoms, the strain was perfectly equal throughout the whole, therefore the plan adopted by him for Lloyd's Committee proved itself to be correct in principle and practice, while its economy was obvious, since by the ordinary mode of testing for the complement of a single ship's chains, viz., 300 fathoms, it took twenty proofs, while at Lloyd's machine it took but four or five, and as it only took two or three minutes to put seventy-five fathoms of the largest chain in the machine, and two or three minutes to place it on the examining bench by such contrivances as he had invented and applied, it would be obvious how greatly increased must be the economy and despatch in the operation. He should regret indeed, therefore, if any obstruction were thrown in the way of that which had been decided by disinterested parties to be a great improvement. Mr. Lenox had stated that his machine was worked by hydraulic power at one end and by lever power at the other, but Mr. Lenox had no means of measuring the proportionate exactness of his levers. Lloyd's Committee declared they were satisfied with the test of their machine, and they said if it was not satisfactory to the public, let three eminent practical men, like Sir W. Armstrong, Mr. Fairbairn, and Mr. Penn, investigate the question, and declare whether he (Mr. Gladstone) was right or wrong in the principle he contended for. Mr. Davison, who had experimented on this machine, stated that there was no differential variation whatever at any of the distances. Mr. Lenox had complained that he (Mr. Gladstone) had omitted to mention a great many other anchors that had appeared. If he had mentioned

all he would have had to include a list of at least eighty patents. He considered the remarks of Mr. Lenox as to swivels in chains very valuable. In his paper he had given a brief notice of the leading forms of anchor, without comment of his own, leaving each form to stand upon its own merits. He had been much interested by the discussion, and he trusted that on a future occasion he should be allowed the opportunity of extending this interesting and important inquiry.

The Chairman said he had now to ask the meeting to express its thanks to Mr. Gladstone for the interesting paper he had read. They must all admit this subject to be of great importance, and one to which a society of this kind could never regret having devoted an evening. The practical object doubtless was to get a good anchor and a good chain cable; but he apprehended that achievement would not be promoted either by patents or by Government patronage, for most of the observations they had heard that evening tended to show that nothing that had yet been done in this direction had been influenced by the privileges conferred by the patent laws or by the patronage of the Government. After all, the most efficient means of obtaining the best thing was to trust to competition among the manufacturers of the country, the stimulus of which would induce them to bring the utmost amount of science and skill to bear on this important branch of manufacture. There was also a further question, whether, considering the vast amount of private property at stake, it was desirable for the Government to interfere to require a proper testing of these cables and anchors. What had been the result of the step taken so far? An act was passed within the last twelve months requiring that all anchors and cables should be tested, and now they found those most interested in the question disputing as to the reliability of the testing machines employed. When the Government system of testing was in full operation, would they be much nearer in arriving at the best anchor than they were now, by going to those whose manufacture had proved to be the best? They had much better rely upon themselves, and the more they threw upon individuals interested the responsibility of providing the best machinery for carrying such works into effect, the better it would be for all parties. In the paper the fact was mentioned that during the great war Napoleon threw such difficulties in the way of our obtaining hemp for our cables that we were compelled to seek for a substitute in the shape of iron. He (the chairman) could not but contrast that period and the conduct of the First Napoleon, with the present period and the conduct of the Third Napoleon—a man who was doing all he could to bring into friendly rivalry the manufacturers of both countries, and in every way to promote commercial intercourse between the two nations, a course of policy which, considering the objects which this Society was established to promote, could not fail to enlist our cordial sympathy. He now begged to propose a vote of thanks to Mr. Gladstone for his excellent paper.

The vote of thanks was then passed and acknowledged.

Proceedings of Institutions.

Manchester Mechanics' Institution.—In their Forty-first Annual Report the directors congratulate the members upon being able to present an encouraging statement of the past year's proceedings. The fears expressed at the commencement of the year, that the commercial depression under which the district was suffering would continue to affect the attendance in the classes, has happily been only partially realised; the number of pupils connected with the various departments in 1864, in most instances comparing favourably with the number attending in 1863. The attendance at the boys' day classes has been satisfactory, showing a slight increase, with a corresponding improvement in the receipts. An examination of the students was held by one of H.M. Inspectors of Schools. At the Government Science Examinations, the candidates from these classes have more than sustained the reputation of the school, and have been awarded two silver medals and a large number of prizes. The attendance averages over 200. Nine candidates were successful in the Oxford Middle-Class Examinations. The attendance at the ladies' day classes is not so good as it was in 1863. In 1861 the number of pupils attending was 242. In 1862 the attendance fell to 229, in 1863 to 201, and in 1864 to 181. These classes have also been examined by the Inspector of Schools. The attendance in these classes, which averaged over 200 in 1863, fell to 180 in 1864. The female evening classes have been well attended. The number of pupils in the summer months was limited, but during the winter quarters the attendance has been so large as to render it necessary to remove the class to a more commodious room in the Institution. The number of pupils on the books in the December quarter was 53. In the evening classes for young men there has been a considerable increase in the attendance, which averaged about 300. Mr. David Baxter has continued his gratuitous services as the teacher of the bookkeeping class. The great success of his pupils at the Society of Arts Examination, is evidence of the ability and zeal with which the class has been conducted. In the Government science classes the number of students who have entered compares favourably with that of the preceding year; but, considering the importance of the subjects taught, the attendance must be deemed far from satisfactory. In the examinations of the Department, however, this Institution has been successful beyond any other. Three silver medals, four bronze medals, and more than one hundred prizes, were awarded, while several students secured "Honourable Mention." The results of the Society of Arts Examination have already been published. Mr. H. J. Leppoc for the second time placed at the disposal of the directors a prize of five pounds, to be divided equally among those students who should most distinguish themselves in arithmetic at these examinations. The annual vacation party of the day classes was held in June, and the usual soirée of the dancing class was held at the close of the year. The gymnastic club still continues one of the most popular features of the Institution. The skill displayed by the members at the last assault-at-arms clearly proved that the club still maintains its high state of efficiency. A challenge gold medal has been offered for competition by Mr. G. T. Lund, in addition to a silver and a bronze medal presented by the committee and the members. The billiard club has been eminently successful during the first year of its existence. It has in a very large degree promoted social and friendly intercourse amongst those who were unable to avail themselves of the other advantages offered in the Institution. The circulation of books from the library has decreased from 32,579 in 1863, to 27,411 in 1864. The directors record with deep regret the death of the chairman of the board, Mr. J. W. Edge, who for very many years had enjoyed the confidence and esteem of the members, as well as of Mr. John Heywood, vice-president. The directors congratulate the members upon the financial position of the Institution. At the commencement of the year there was a balance in hand of £679 7s. 2d., with unpaid accounts amounting to £187 15s. 5d. There is a balance of £998 3s. 4d., with unpaid accounts amounting to £171 9s. The income has amounted to £3,037 6s. 8d. The total number of members is 1,531, against 1,307 in the previous year.

ANGLO-FRENCH WORKING CLASS EXHIBITION.

A meeting of working men was held in the Society's great room (by permission of the Council), convened by the promoters of the above undertaking, on Tuesday evening, the 23rd inst., William Hawes, Esq., Chairman oft he Council, in the chair.

The CHAIRMAN, in opening the meeting, said that the Council, upon receiving a communication from Mr. Coningsby, the secretary to the committee formed for carrying out this proposed Exhibition, stating what steps had already been taken in this movement, and the success of the preliminary measures both in England and in France, were desirous that the Society should offer every encouragement to the undertaking. For his own part, he (the chairman) felt especial pleasure in presiding over what he might almost call the first meeting which had been held in this metropolis for the purpose of uniting the English and the French workman in friendly rivalry, the object being not so much to prove that the one was superior to the other in any particular branch of art or of manufacture, but to give them an opportunity of showing each other that in which each excelled, so that the workmen of both countries might learn in what direction they should apply their time and talents, so as to produce the most beneficial results to themselves, and the countries in which they respectively lived. It was quite clear that both England and France, from the great intelligence, perseverance, and industry of their people, must necessarily be constantly rivals; but it was of the utmost importance that their rivalry should be a rivalry of friendship, and not a rivalry arising from feelings of distrust or national prejudice. He could imagine nothing better calculated to produce a friendly rivalry likely to benefit both countries than this proposed Exhibition. This was a year, certainly, in which such an exhibition might be very appropriately organised, being the fiftieth year of peace between the two countries. That fact in itself was a remarkable evidence of how great a length of time was required to remove prejudice when once it was deeply seated between nations. It appeared to have taken fifty years before the working men of both countries, who formed the great mass of the population, could meet upon terms of peace and good fellowship, and enter into friendly competition with each other. However glad we might be that such a result was brought about at last, we could not help feeling what a melancholy instance this was of the great mischief which followed long and devastating wars, and the great amount of prejudice and ill-feeling which were thus engendered to the great detriment of the world at large, and more especially of those countries where such wars were carried on. Now, however, that these fifty years had passed, we could not but hope that the good feeling between the two countries would increase year by year, stimulated as it was by the enlightened men of this country, as well as by that great man who was now the ruler of the French people. It was remarkable how much had been accomplished by that illustrious sovereign, whose acts had so materially aided the progress of free-trade in Europe. Without that encouragement, which happily the Emperor had not only the will but the courage to give to free-trade and free communication, he (the chairman) really believed the progress which had been made would not only not have been accomplished, but would even now have scarcely been begun. During the Bourbon dynasty there appeared to be little chance for such free communication between England and France as there now was, for he was sure they must all feel that the abolition of passports and the interchange of commodities now carried on under the French treaty were remarkable proofs of the truly enlightened spirit in which the French Emperor regarded questions of international commercial policy, and he had little doubt that the undertaking which they had now met to consider would receive every encouragement from the French Government. He would now call on Mr. Coningsby to explain the steps that had already been taken in connection with this movement. After that some resolutions would be proposed in order to promote the success of the undertaking.

Mr. R. CONINGSBY said he would begin by stating that they did not, however anxious the committee might be to secure the support of all present, now come to ask if this thing should be done, but only how it should best be done. They were too far committed to it to retrace their steps. The origin of the scheme was something like this. A few friends and himself went to the Agricultural Hall last October, when the North London Exhibition was being held there, with the view of carefully examining the exhibition, so as to see what representation it was of the best productions of the working-classes. Without wishing to depreciate that Exhibition, he must frankly say they could not regard it as a fair representation of what the working classes really could do, and feeling this, they took counsel together whether something could not be done that would give to the section of the working classes not represented there an opportunity of coming forward and showing what they could produce. A committee was formed of about 40, all of whom were working men. There were no patrons, and at first it was decided to have none, that anybody who liked might help the movement, but that the Committee would not solicit patronage. They thought their first step should be to find what amount of assistance they could expect from their own countrymen. Many of the committee-men were foremen in large establishments, and these men talked both with their shop-fellows and employers as to what countenance they would give them. This was done before they committed themselves to the scheme at all, and before calling any public meeting. From inquiries made it appeared that the scheme was likely to take, and the committee had many promises of help, both from workmen themselves and their masters. Those of the members who had friends in provincial towns wrote to them, and found that they received the matter in a very favourable manner. It then came to be a question whether this should be a local movement, or whether they should invite competition from a larger area. It was decided that there was no great use in circumscribing the affair, and, as this year was the fiftieth anniversary of peace between England and France, they thought of making it a jubilee movement, and inviting the French workmen over to compete with them. It was rather a difficult matter to find out whether the French would enter into it or not. The English were ready enough, but they felt some diffidence in going to France as the representatives of English working men. It seemed something like the three tailors of Tooley-street being the representatives of the British people, and they were therefore careful in stating to the French that they merely represented their own committee. Five of them were requested to go to Paris. Their own committee subscribed all the necessary funds, and asked nobody for a penny. They went to Paris, and took a few letters of introduction with them. The idea had been well received here, but when they got to Paris they found that it was received with enthusiasm. Every person they called upon—no matter what his position—whether workman, senator, or manufacturer, gave them the same warm welcome. He was sure every member of the deputation would bear him out when he said that it was quite a mistake to suppose that there was any coldness on the part of the working classes of France towards this country; they had the warmest feelings for us, and he thought that if this matter had stopped here, and had gone no farther, it would be worth all the trouble they had taken to ascertain this one great fact—that there is no ill-feeling or prejudice existing in the minds of our social equals in France towards the workmen of England. They were taken up by a society called the "Société du Crédit au Travail." He believed there was nothing like this society in this country; it was a sort of bank, into which every member put 100 francs, which was laid out in the purchase of land. It was a very responsible organisation, and the deputation were recommended to it by M. Michel Chevalier. This society called a meeting of delegates, representing all the principal associations in Paris, to the number of about eighty. They put a great many questions to the deputation; they did not want to go into the matter at hap-hazard, but wished to know the

grounds of success. They were told frankly what had been done from the very commencement, and given distinctly to understand that they were not there as representing the English workmen, but only their own committee. The meeting passed resolutions approving of the scheme, and, on the spot, appointed a committee of ten gentlemen, well known in connection with the Crédit Foncier and other important organisations, and many of them being also chairmen of large co-operative associations. That committee promised to send a circular to each of the departments, and, as three of them were editors of newspapers, they promised to use their influence through the press, and gave every prospect of a wide co-operation on the part of the French people. The deputation called on about five-and-twenty manufacturers, to whom they had letters of introduction, and found that to a man they were all ready to send their goods to the Exhibition. The Crystal Palace had a great name in Paris: people there believed in it, and as soon as they heard that their visitors came from the Crystal Palace they were quite ready to send their goods. M. Edmond Potonié was appointed as the secretary of the French committee, and favourable notices of the movement had been given by the French papers. The French Committee reported that they believed they would be able to send over a large amount of goods, and they were in a position to do this because they had large manufactories there, conducted on principles similar to those of our co-operative institutions in this country—extensive factories, from which a large quantity of goods for exhibition might be expected. The next step they were about to take was to send one of their number to Paris, to watch the interests of the affair, and to communicate between the two committees. The steps they had taken since their return to England might be soon summed up. The Society of Arts, through its Council, had taken up the movement with very great kindness. They had lent them this room for their meeting here, and the Chairman of the Council had been good enough to preside. Their object now was to lay their scheme before the meeting for their approval and assistance, which would be highly valued.

Mr. WHITEING proposed the following resolution:—

"That this meeting, having heard the statement of Mr. Coningsby, in reference to the proposed Anglo-French Exhibition, recognizes in this movement an evidence of the gradual extinction of national prejudices, and of the great advance which has been made by the workmen of both countries in the knowledge and appreciation of the true principles on which the material prosperity and moral progress of nations depend."

He said that one object they had in calling the present meeting was to ask assistance in one department of the proposed Exhibition, namely, that of Art-workmanship. There could be no doubt that in the working men's exhibitions which had already taken place in London art-workmen had not been fairly represented, and it was very important that they should be in the present one.

Mr. WILLIS seconded the resolution.

Mr. LUCRAFT was sorry that he could not support the scheme, not that he did not approve of it, but only because he thought there would not be time to get up the Exhibition in such a manner as fairly to represent the British workman, who would thus be placed in an unfair position. He suggested that the Exhibition should be put off till next year, and that then not only French workmen, but those in all the countries of the continent and of the world should be invited to take part in it.

Mr. ANSON thought the proposed Exhibition was a step in the right direction, and that it would instruct British workmen, and prepare them for future competitions. He felt so deeply interested in the movement that, though not affluent, he should be glad to be responsible, in the case of failure, to meet the expenses to the extent of £5.

Mr. ASHE and Mr. BUCK highly approved of the scheme, and the latter gentleman said he was sure there would be plenty of time before the Exhibition opened for British workmen to prepare articles for show.

Mr. PEARSALL (Secretary of the London Mechanics' Institution) congratulated the meeting on the success of the movement as far as it had gone. He believed the Exhibition would form a new and desirable link between employers and workmen, if, as he believed they would be quite willing to do, the masters would exhibit work done in their establishments with the names of the workmen attached to it. English and French workmen had much to teach each other and to learn from each other, and the proposed Exhibition would be an excellent opportunity of bringing them together.

Mr. WINKWORTH strongly supported the principle affirmed in the resolution, and stated his belief, founded on his experience as an adjudicator in the Great Exhibitions of 1851 and 1862, and of the Paris Exhibition of 1855, that English workmen need not fear to enter into competition with those of France. The progress made by the English in the silk manufacture between the two exhibitions was such as to astonish even the French people themselves. He believed the time was fully come when such an exhibition as that now proposed should take place, and that it would be of benefit to both countries.

The resolution was then carried unanimously.

Mr. LOCK moved—

"That this meeting pledges itself to promote by every means in its power the success of the undertaking."

So much had been said in support of the movement that it required nothing to be added to it, but he would suggest to the Committee that they should use their utmost exertions amongst the employers of labour, who were in possession of most of the works produced during the last few years by Art-workmen, and who would, doubtless, be glad to aid in promoting the success of the scheme. It was also necessary, in order that the exhibition might be thoroughly successful, that there should be the fullest confidence in the persons selected as adjudicators of the prizes.

Mr. MAYNARD seconded the resolution, which was unanimously carried.

Mr. R. CONINGSBY moved a cordial vote of thanks to the Society of Arts and to the Chairman, which was carried by acclamation.

The CHAIRMAN said that it was undoubtedly one of the most important functions of the Society of Arts to encourage Art-workmen. Arts, Manufactures, and Commerce were based upon the skill of the workman, and he conceived, therefore, that they were only doing their duty in endeavouring to promote this movement. He had already given them his opinion of its importance, and he would now only tell them what he thought about its success. When Prince Albert attended a meeting in that room previously to the Exhibition of 1851, and some doubts were expressed as to its success, his answer was, "Gentlemen, you will succeed because you are determined to succeed;" and the same remark might be applied to the present undertaking. The promoters of this movement had shown so much determination, and had received so much encouragement both here and in France, that there seemed little doubt as to their success. The movement must be a combined one between masters and men; masters must be willing to show their workmen's work, so that the actual producers might have the credit, which had hitherto too often been kept from them. The great value of such exhibitions was the strong stimulus they gave to progress and the promotion of self-respect and honourable feeling amongst workmen. If the masters would not allow the men to exhibit fine specimens of work which they had executed, a great part of the use of the Exhibition would be lost, but he felt sure that the masters would unite in promoting this friendly rivalry between their workmen and those of France. It had been said that English workmen must be beaten in matters of taste by the French, but was taste the only thing that was

required in work, and were there not other qualities of as great if not greater importance? It was a remarkable fact, that so astonished were the French themselves at the progress we had made between the two Exhibitions of 1851 and 1862, that they actually sent over a commission to see by what means we had so improved our art manufactures in the short space of eleven years. The French people had to learn to imitate the solidity and lasting character of our work, and we had to learn the taste and elegance of theirs, so that there was much to learn on both sides, as well as much to teach, and every opportunity of doing this was a benefit to both countries. In conclusion, he would say that they were quite welcome to the use of the Society's room for their meeting. Anything the Society could do to promote the success of the Exhibition would be done. He thanked them for the compliment paid to the Society and himself in the vote just passed.

Fine Arts.

THE DE MORNY COLLECTION.—The late duke was a liberal patron of art and artists, and his collection of pictures and other objects of art and curiosity is certainly one of the most remarkable that was ever brought together in a period of ten or twelve years. The sale is fixed to commence on the last day of the present month of May, and to conclude on the 12th of June, the first four days being devoted to objects *d'art* and curiosities. The private views take place on the 25th and two following days, and the public exhibitions on the 28th and 29th instant; and, as a large attendance of amateurs and virtuosi is expected, it will be well to give the readers of the *Journal* a general idea of the contents of the collection. M. de Morny was a great admirer, and considered to be a good judge, of the works of the German, Flemish, and French schools, but he seems to have had little taste for the great Italian masters or for sculpture. Amongst the old paintings of the German, Flemish, and Dutch schools there are:—Three pieces by Cuyp; an excellent little work by Gerard Dow; one of Hobbema's finest works, known as Les Moulins, a glowing landscape—a river and mills, and five clumps of oaks, for which the late duke gave 100,000 francs; good specimens of Denner, Dusart, Erverdingen, Helst, Heyden, De Hoogh, and Huysmans; a very fine work by Maas, a robust servant girl ringing at a house door, with three children near; three remarkable pictures by Metzu; an admirable Miéris, the itinerant musician asleep in a cabin; three pictures by Ostade; a Paul Potter; one of the finest portraits extant by Rembrandt, a man in the prime of life, wearing a broad-brimmed hat, his face brillantly lighted up, known as Le Doreur, from the Chavagnac collection, as perfect as when it left the artist's hand, signed, and dated 1640; Europa, a small composition; and the portrait of an old woman, also by Rembrandt; Hercules and Omphale and a portrait by Rubens; three works by Ruysdaels; one by Jan Steen; two by Teniers; and three each by Ferburg, Van der Velde, and Wouvermans.—The elder French school includes, amongst other choice works, two fine pictures by Chardin; two of Fragonard's best known paintings; six by Greuze, including his famous Peasant Girl winding cotton; three of Prudhon's most admired works—Innocence, Cupid and Psyche, and Zephyr; and four good specimens of Watteau.—The contemporary French works include some very fine pictures, amongst which must be specially mentioned the Ape painting, by Decamps; six works by Meissonier, including two of his finest productions—The Bravos, 1852, and Halt of Cavaliers at the door of a country inn, 1863, which have never before been in the market; and four exquisite examples of his more usual style—a young man eating and reading; the amateur of drawings; a poet and a young man studying; and three charming works by Alphonse Rœhn, a French artist, who died last year, but whose works recal the best period of the Flemish school.—The Italian and Spanish schools are only represented by five works by Guardi, excellent specimens; two or three by Murillo; two of Salvator Rosa; and two Velasquez.—The collection of objects of art and curiosities consists almost entirely of Chinese and other oriental works in enamel, porcelain,, rock crystal, jade, and lacquer, many of which are very choice.

RAPHAEL'S FRESCOES.—A Parisian photographer has recently returned from Rome with twenty-seven plates of the frescoes of the Farnese Palace.

MONUMENT TO DANTE.—The inauguration of the monument raised in Florence in honour of the great poet of Italy, took place on the 14th May, with great ceremony, in the presence of King Victor Emmanuel. There was a grand procession, which occupied more than two hours in passing. First marched the representatives of the press (Italian and foreign); next came those of the Italian drama; then a long file of persons deputed from every province, town, academy, society, and important institution in the kingdom. Seven hundred banners floated in the air. The *cortége* was closed by the colleges, the national guard of Florence, in the ranks of which marched the Count Sarego Aligheri, descendant of the poet. The King was received with immense acclamations; upon his majesty's arrival the Gonfaloniere of Florence pronounced a short address, after which Padre Jean Baptiste Giulani delivered a discourse on Dante and and his works, at the conclusion of which the veil which until then had covered the monument fell to the ground. The entire arrangements proved satisfactory, and the enthusiasm is declared to have been indescribable. Such an act of national pride and fervour does honour to the capital of united Italy.

SALE OF ARTISTIC FURNITURE.—The sale of a remarkably fine collection of objects of Industrial Art took place recently in Paris. The articles disposed of belonged to the late Prince de Beauvau, and although consisting of but forty-four lots of furniture, bronzes, porcelain, and sundries, with seven pictures, the proceeds of the day's sale were £14,392. The most precious item in the former portion of the collection was a small secretaire of the time of Louis XVI., presented by Marie Antoinette to Madame Sénone, one of her ladies of honour, purchased for the Empress at £2,400. A commode, inlaid with marqueterie, and ornamented with chasings in bronze, by Gouthières, the cyphers of Marie Antoinette appearing amongst the ornaments, fetched £1,004. A console, in marqueterie, by a celebrated art-workman, I. H. Reisener, and bearing his signature, of the same period, sold for £828. Two small sofas, or settees for two persons each, fetched £400. A small ebony coffer, decorated with five Florentine mosaics, £118. An inlaid clockcase of the time of Louis XIV., £120. A small bureau of the time of Louis XIII., £122. A carved and gilt bedstead of the Louis XV. period, £162. A cup in Sicilian jasper, mounted in bronze, chased and gilt, by Gouthières, £1,276. Two candelabra, by the same artist, figures of Bacchantes, after Clodion, £644. An inkstand, attributed to the same artist, £232. Two candlesticks, ditto, £166. Pair of fire-dogs in bronze, chased and gilt, time of Louis XVI., £102. Six lots of porcelain fetched £1,872. A jewel-box in copper gilt, bearing the cyphers of Henry II. and Catherine de Medicis, £304; and two vases of porphyry, £644.

Manufactures.

NEW KIND OF FUEL.—A fuel has been invented by Mr. Stoker composed of carbon in powder as pure as possible, obtained from the distillation of light woods in a close receptacle of various metallic salts and acids acting as the combustible matter, and of different agglomerating bodies

such as fecula, &c. The whole is triturated, mixed, and pressed, forming a paste, which may be moulded into cakes, balls, &c., of various sizes, to be afterwards dried. When dry this fuel may be lit by a lucifer match; it burns like a piece of tinder, and gives out neither smoke, gas, nor flame. The caloric disengaged in the burning of this fuel may be from 45° to 720° Fahrenheit, according to the proportion of the different component parts above cited. This fuel (says the inventor) will be found very useful for heating feet-warmers, for urns, dishes, and similar articles, for placing in plumber's soldering irons, or in irons for pressing linen; for heating glue in workshops or elsewhere where a fireplace would be inconvenient or dangerous, and for many other purposes.

New Gas for Motive Engines.—The Motor Lenoir has achieved considerable success, but its application is limited to the supply and cost of the gas required to work it, and it is said that an engineer of Lyons, M. Million, has hit upon an expedient which is likely to have a great effect in extending the use of that or other motors in which power is obtained by the explosion of mixed gases. The problem is to find a gaseous mixture which takes fire easily and rapidly, and which can be produced in almost any place at a low cost. This desideratum is believed to have been discovered in the gases which are given out when steam is made to pass over coke in a state of incandescence, or, in other words, in a mixture composed of oxide of carbon and carburetted hydrogen. The subject has been introduced in a lecture at the Sorbonne, and before the Scientific Association of Paris, by MM. Schlœsing and Demondésir, the engineers of the tobacco manufactory, and M. Troost, and has attracted considerable attention. In the experiments performed it was shown that when oxide of carbon alone was introduced into a vertical tube, and fired by a spark from a Ruhmkorf coil introduced at the upper end, a blue flame appeared and slowly traversed the tube until it reached the bottom, and that the introduction of a small quantity of hydrogen accelerated the combustion, and caused the flame to descend with greater rapidity. This was illustrated by a tube more than eighteen feet long. Another experiment showed that when the explosion was caused in a series of vertical tubes alternately connected together above and below, the flame when ascending traversed the tubes more quickly than when descending. The engineers mentioned are now carrying on a series of experiments to ascertain the most economical mixture of these gases with atmospheric air for motive purposes, and success is considered to be almost certain. It must not be forgotten, however, that although the new system may supply a cheaper and possibly more effective motive power, it will have one drawback that does not attach to the Lenoir motor, which can be used in workshops and other places where it would be impossible or inconvenient to introduce a furnace. As steam will be required to produce the gaseous mixture, the new motor will come into direct competition with the steam-engine, which the motor Lenoir does not.

Commerce.

French Trade with Abyssinia.—An expedition is announced to depart from Paris in the month of June, having for its object the establishing of a trade between the natives of Abyssinia and the French merchants in the Red Sea. The spot selected for the head-quarters of the expedition is Mount Taranta, which is not within the possessions of that dangerous monarch, King Theodore, and where the climate is described as being very temperate and healthy. The point of operations on the sea coast is to be Halaï, near Port Adulis. The funds are obtained by means of subscriptions from the persons engaged in the expedition, and it is said that the number already enrolled is sufficient to ensure the carrying out of the project. The projector and leader of the expedition is Count de Moynier, who is half an Englishman, his mother having been the daughter of General William Burn, whose services in India gained him the soubriquet of the Hero of Delhi. Count de Moynier announces in addition arrangements for affording sportsmen a chance of elephant and otter shooting in connection with the expedition, which will be armed and organized against any danger from the natives.

Colonies.

Arrowroot in New South Wales.—Experiments have recently been made on the root of the Cumbungah, a common reed, growing abundantly in the lagoons of the south-western districts, and possessing, it is believed, properties capable of affording employment to hundreds of persons. An excellent species of arrowroot has been made from this plant.

Docks in New South Wales.—The Fitzroy Dock, belonging to the Government, situate at the penal establishment of Cockatoo Island, is capable of taking in vessels of the largest tonnage. The Waterview Dock is very largely used in docking the vessels engaged in the mail services and those belonging to several local companies and proprietors, and is capable of taking in the largest class of ships. Adjoining are shipwright and engineering works, large shears for masting purposes, and every requisite for the repair of vessels in the several branches to which they apply. The floating dock in Darling Harbour is chiefly used in docking sailing vessels and small steamers. There is a very large establishment formed for making large power boilers and heavy machinery, provided with steam hammers for heavy forgings, large lathes, and all requisite tools for the construction or restoration of engines of large dimensions. The slip dock is capable of taking up separately two vessels of about 1,000 tons each. At these works four iron vessels have lately been built, adapted to the peculiar requirements of short river navigation, one of which was a gun boat built for the New Zealand Government, fitted with shot-proof towers, which has done good service and taken a very prominent part in the history of the present New Zealand war. The vessels are of large dimensions, to ensure a light draught of water.

Queensland Imports and Exports.—The total value of the imports for the year 1864 was £2,267,954, of which £1,746,841 came from Great Britain, £506,697 from the other Australian colonies, £7,370 from Germany, £6,880 from South America, £100 from the South Sea Islands, and £36 from New Caledonia. The total value of the exports for the year was £1,243,903, of which £354,437 were sent to Great Britain, £889,368 to the other Australian colonies, £632 to India, £7 to Ceylon, £24 to China, and £4 to South America. The comparison of these tables with those of former years shows the rapid progress the colony has made since 1860. If those who have been induced to settle there had not succeeded in obtaining profitable employment, they could not have afforded the luxuries which have been imported, and the total amount must have been greatly reduced as well as the average per head.

Rents of Crown Land in South Australia.—For many years the best pasture lands in the colony were leased at one farthing per acre yearly, until, in 1858, an Assessment on Stock Act was passed, making the payment for rent and taxes together one penny per acre yearly. This was, of course, still far below the value, and as in June of the present year, a large number of the leases expire, the lands comprised therein have been re-valued, and the average rent and assessment for the first batch of the best runs now amounts to about 6d. per acre per annum, which have been confirmed by the Government. Many farmers, however, are paying 1s. and 1s. 6d. per acre to private persons for grazing land.

Notes.

COTTAGERS' EXHIBITION AT AMBERLEY, GLOUCESTERSHIRE.—Some time ago the Rev. R. E. Blackwell, the incumbent of this parish, which has only 1,400 inhabitants, conceived the idea of finding some means by which poor people might be enabled usefully to amuse themselves in the winter evenings without having to leave their houses. The problem he wished to solve was how to find interesting and amusing occupation for the poor man at home during the winter months, and his idea was to get the poor to make whatever articles their taste or inclination prompted them to make, and which would yield them a return when they were sold at an exhibition that should take place at the winter's end. Last October, therefore, he issued a circular addressed to them, in which he said:—"My plan is to try and set all of you—men and women, boys and girls—to work in a pleasant way in your own houses, at your odd moments, during the winter, and for you to gain something by it. At some suitable time in the spring, I should like to have in our schoolroom an industrial exhibition. During the winter months I would have you all work for this, according to your own different tastes and powers; one making one thing, and one another. Everything you make will be your own. At the time fixed for the exhibition, I will endeavour to gather together our friends throughout the neighbourhood—and sell for you the things you have made, if you wish them to be sold. I do not promise to sell them, but I will try to do so. Let everybody make a something, however small or simple. Do not be shy, or hesitate to join our workers. Let every person in the parish be an exhibitor, and try and make something which will do him credit. Great moral benefits must result if we endeavour to spend our winter evenings in a profitable way." Mr. Blackwell suggested what kinds of thing could be made, and during the last six months nearly every cottage has been the nightly scene of work for this exhibition. Men, women, and children have been busy. There has been a curious reversion of labour; for weavers have done carpenters' work, and the industry of others has taken a direction equally strange. The articles made, together with others lent by ladies and gentlemen of the neighbourhood, were recently displayed in the schoolroom. Rugs and quilts, worked with every material and in every colour by the women and girls of the village, draped the walls. The articles of industry comprised vases, plates, and figures, sculptured in freestone; a model landscape; an obelisk in shell work; pencil drawings of cottages and gardens, done by boys; a shapely stone table, with ornamental pillar; a fancy oak table; a model church in stone; a spirit-level; a case of artificial flowers worked in wool; ingenious comic drawings; shoes, slippers, stockings, and other articles of dress. There was an ingenious rat-trap, for which a prize of £1 was given by the Ratcatching Club of London; a well-carved book-stand; a music-stand; and many other articles. The room has been crowded with visitors, and Mr. Blackwell was present to show the articles, most of which have been sold.

Correspondence.

ON THE WEAR AND TEAR OF STEAM BOILERS.—SIR,—I have seen Mr. Paget's double-barrelled letter in your last number, and observe there is a deal to be said on both sides of the question; but I shall confine my remarks within a very narrow compass. The essence of my first letter (in your number for May 12th) with respect to the furrowing of boiler-plates is, that Mr. Paget has adopted precisely the same view of the cause of furrowing that I did five years ago, namely, the action of the steam-pressure to straighten, or at all events to make more nearly straight than before, the common lap-joint, and thus to bring about an alternate bending and unbending of the metal, resulting in a loosening of the texture, and a greater susceptibility to corrosion. Now, I fail to find this central idea enunciated, or even hinted at, in the parallel column in Mr. Paget's letter. The only thing like it is in Mr. Braithwaite's paper, "On the Fatigue of Metals," where he refers to the buckling of locomotive smoke-box plates, in consequence of the strains from the cylinders, which are entirely exterior to the boiler. To this buckling action I alluded in my last letter. Mr. Renton, to whom Mr. Paget refers, does not in his pamphlet even hint at any explanation of furrowing action. With respect to the pitting of boiler-plates, I stated in "Recent Practice," that—

"The pitting of the metal is readily explained by the presence of chemical agents in solution in the water, and the known inequality of substance of iron plates and bars, in consequence of which the metal is gradually but unequally separated and dissolved."

This, in like manner, is the essence of Mr. Paget's enlargements on the pitting of steam-boilers. In the same book, "Recent Practice" (pages 16, 17), I explained the causes of the failure of the stay-bolts of locomotive fire-boxes in the following terms, which I am obliged to quote for the benefit of Mr. Paget, who has vainly strived, he says, to find the explanation:—

"Copper expands by heat half as much again as iron, and taking the mean temperature of the copper of the fire-box at twice as much as that of the shell, an assumption which, we suppose, is something much below the fact, the vertical expansion of the fire-box would be, upon the whole, three times as much as that of the shell, and the difference of expansion would be twice that of the iron, or at the rate of 1 in 500. On a fire box five feet three inches high, the difference of expansion would at this rate amount to one-eighth of an inch. That is to say, the upper stay-bolts would be deflected one-eighth of an inch from their normal position, when under the power of high-pressed steam. On a length of stay-bolt of three inches, a deflection of one-eighth of an inch is immoderate; and, considering the alternate expansion and contraction, bending and relaxing, attendant upon getting up steam and letting it down, it is reasonable to conclude that the same cause of degradation is at work with the stay-bolts as that already suggested for boiler-plates at the rivet-joints,—the alternation of strain, tension and relaxation, which loosens the texture, and ultimately overpowers the cohesion of the material so treated, incurring partial fracture and accelerated corrosion. On this argument the failure of stay-bolts should, as in fact it is, be localised at or near their junctions with the plates, which are the points of maximum strain, similarly to the localisation of furrows near rivet joints. Occasionally, entire rows of rivets are found to have snapped across, close to the plate, independently of corrosive action, suggesting a cause of failure precisely the same as that which breaks axles—an alternating lateral strain and relaxation beyond the limits of enduring elasticity."

* * * * * * * *

"The reasons above advanced afford an explanation of the fact that fire-boxes with narrow water spaces are more subject to leakage than those with wider spaces, the stays being shorter and less flexible in the former case, and likelier to fail. For the same reasons, stay-bolts of smaller diameter, sufficiently strong, are preferable to others of larger diameter. They are more elastic, and yield to unequal expansion more readily than thicker stays, and are, therefore, likely to be more durable."

In fine, Mr. Paget is quite welcome to the use of what I have before published; and, whether he acknowledges it or not, there is no doubt it forms the basis of the greater portion of his paper. Of course he has largely superadded illustrative and corroborative matter, which he appears to have expanded into what he calls the "bulging theory," whereby there is a disposition to convert a cylinder into a sphere. I believe I have said all that is necessary in explanation of my letter.—I am, &c.,

D. K. CLARK.

11, Adam-street, Adelphi, May 22, 1865.

MEETINGS FOR THE ENSUING WEEK.

MON. ...British Architects, 8.
Asiatic, 3. Annual Meeting.
TUES. ...Civil Engineers, 9. President's Annual Conversazione.
R. Horticultural. Scientific meeting, 3 p.m. Mr. Bateman, "On *Cuitlanzinia pendula*, and a New African *Angræcum*, brought home by Capt. Grant."
THURS...Antiquaries, 8.
Linnæan, 8. 1. Dr. Cobbold, "On Animal Individuality." 2. Dr. Baird, "Contributions towards a Monograph of the Annelides belonging to the *Aphroditaceæ*." 3. Mr. F. Walker, "Synopsis of the *Diptera* of the E. Archipelago."
Chemical, 8. Dr. W. A. Miller, "Analysis of Potable Waters."
R. Society Club, 6.
FRI......Philological, 8.
Royal Institution, 8.
Archæological Inst., 4.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 13th and 15th May, 1865.*

256. Game Certificates (Ireland)—Return.
125. Bills—Drainage and Improvement of Lands Acts (Ireland) Amendment.
127. ,, Dogs Regulation (Ireland).
255. Newspapers and Stamps (Ireland)—Return.
258. Judgment Office (Ireland)—Returns.
261. St. Benet Gracechurch-street, &c., Benefices—Return.
264. Distillers, &c.—Return.
126. Bills—Arrests for Debt Abolition (Ireland).
128. ,, Turnpike Tolls Abolition.
129. ,, Customs and Inland Revenue.
130. Pier and Harbour Orders Confirmation.
131. Pilotage Order Confirmation (No. 2).
134. Forfeiture for Treason and Felony.
135. County Voters Registration (amended in Committee).
3. (305) Railway and Canal, &c., Bills—Board of Trade Report, Part 305.
234. Fethard Dispensary—Correspondence.
263. Dublin Corporation (Bills in Parliament)—Account.
132. Bills—Local Government Supplemental (No. 4).
134. ,, Forfeiture for Treason and Felony (a corrected copy).
138. ,, County of Sussex.
139. ,, Smoke Nuisance (Scotland) Acts Amendment.
140. ,, Ecclesiastical Leasing Act (1858) Amendment.
251. Civil Service—Report to the Lords of the Treasury in June, 1860.
269. Marines—Returns.
277. British Museum—Accounts.
136. Bills—Commissioners of Supply Meetings (Scotland) (as amended in Committee).
141. ,, Prisons (as amended by the Select Committee).
142. ,, Exchequer Bonds (£1,000,000).
143. ,, Locomotives on Roads (as amended in Committee, and on Consideration).
144. ,, Postmaster General.
215. Military Expenditure (Ceylon)—Despatch, &c.
260. Piccadilly and Park Lane New Road—Minutes of Evidence.
271. Merchant Seamen's Fund—Account.
272. Seamen's Savings Bank—Account.
274. Ramsgate Harbour—Statement.
178. Water Companies, &c.—Return.
3 (306). Railway and Canal, &c., Bills—Board of Trade Report Part 306.
Endowments for Education—Minute.

Delivered on 16th May, 1865.

137. Bills—Harwich Harbour.
146. ,, Crown Suits, &c.
235. Sugar, &c.—Tabular Return.
250. Savings Banks—Accounts.
250 (I). Savings Banks—Return.
270. Savings Banks—Account.

Delivered on 17th May, 1865.

147. Bill—Churches and Chapels Exemption (Scotland).
206. Cathedral and Collegiate Churches—Return.
257. Excise and Customs (Ireland)—Return.
266. Oaths and Declarations—Return.
282. Public House Closing Act (1864) Amendment Bill—Return.
Education (Science and Art)—Twelfth Report.
Education (Scotland)—Minute of further Suspension of Revised Code.

SESSION, 1864.

577 (I). Taxes in Europe—Return.

Patents.

From Commissioners of Patents Journal, May 19th.

GRANTS OF PROVISIONAL PROTECTION.

Alarms, self-acting, for indicating excess of heat or cold—1223—J. H. Johnson.
Buildings, construction of fire-proof—1170—J. Cunningham.
Candles, ornamenting—1299—P. Brash and R. Irvine.
Corn, &c., apparatus for grinding—1267—J. Hurt and H. Tonge.
Cotton and wool, presses for—846—W. Miller.
Cutlery, composition for cleaning, &c.—1054—G. Mountford.
Cylindrical castings, moulds for—1295—D. Hartley.
Cylindrical or conical articles, apparatus for cutting—1247—G. Redrup.
Decoctions, obtaining—1227—F. Wise.
Door mats—1283—T. J. Mayall.
Dredgers—828—W. Simons and A. Brown.
Extracting copper—1255—W. Henderson.
Fabrics, elastic knitted or looped—1275—R. B. Cooley.
Fibrous substances, apparatus used in carding—887—E. & F. A. Leigh.
Fire-arms, breech loading—1289—J. C. Conybeare.
Fire-arms, breech-loading—1293—P. O'Hagan.
Fire-grates, &c., supplying fuel to—1259—C. Lamport.
Fires, self-acting apparatus for extinguishing—1279—J. G. Hey and V. Savory.
Gases and vapours, method of mixing—1287—W. Jackson.
Grain, &c., self-acting and self-registering machinery for weighing—823—T. Roberts and L. Luc.
Illuminating purposes, apparatus for—1269—P. A. Le Comte de Fontainemoreau.
India rubber, treatment of—1257—T. J. Mayall.
Iron, apparatus for puddling—1221—T. F. Cashin & J. F. Alexander.
Jacquard and indexing machines—1261—J. Wadsworth, H. Dusset, and J. McMurdo.
Malt and grain, drying—1297—J. Forbes.
Metal, drilling and rivetting plates of—1291—D. Adamson.
Minerals, apparatus for working or cutting—1203—W. Leatham.
Motive power, machinery for obtaining—1301—W. J. Rice.
Motive power, obtaining and applying—1303—S. Pokutynski and M. Mycielski.
Pen, self-supplying—1231—J. Catillon.
Railway trains, communication between the passengers and guard of—1265—S. Trotman.
Refrigerator and condenser—1249—J. Hampton.
Saddles, safety stirrup for—1285—S. Hudson.
Ship compasses—1251—J. Lilley.
Ships, applying water as a motive power for—1053—G. Rosselet.
Ships, &c., construction and protection of—1209—G. Johnson.
Steam engines—1195—A. Wyllie and J. McF. Gray.
Steam engines, marine condensing—1253—T. Wood.
Tombstones, application of devices to—1130—A. Grainger and C. M. Girdler.
Topograph—84—A. F. Lendy.
Turkish towelling—1281—J. Gorton.
Window sashes and frames—1273—J. Casey.

INVENTION WITH COMPLETE SPECIFICATION FILED.

Flour mills—1348—H. A. Bonneville.

PATENTS SEALED.

2911. H. L. Maquet.	2933. J. Eastwood and W. Wadsworth.
2912. J. Snider, jun.	2937. J. White.
2913. W. Ibotson.	2941. P. E. Gaiffe & E. Zglinicki.
2914. P. E. Gay.	2942. E. Cottam.
2917. R. Morrison.	2948. L. Leisler.
2920. G. M. de Bayelt and J. E. Vigoulete.	2949. J. Grundy.
2923. F. Millns.	2951. C. Reeves.
2924. S. Price.	2993. J. Soper.
2932. J. Kassack.	272. T. Hall and S. Bonser.
	333. W. P. Wilkins.

From Commissioners of Patents Journal, May 23rd.

PATENTS SEALED.

2956. J. Evans.	3095. J. B. Thompson.
2959. L. A. W. Lund.	3105. J. and J. Leeming and J. Lister.
2962. W. E. Carrett, J. Warrington, and J. Sturgeon.	3180. J. G. Aram.
2971. A. I. L. Gordon.	65. J. Welsh.
2972. G. Axton and J. Leach.	468. J. G. Jones.
2977. J. D. de Boulimbert.	574. C. J. Falkman.
2982. E. W. Otway.	617. A. Akeroyd.
2985. H. Caunter.	861. C. J. L. Leffler.
3058. J. Norton.	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1505. E. J. Bridell.	1521. W. Naylor.
1551. W. Roberts and T. Greenacre.	1543. G. Crawford.
	1544. J. Needham.
1519. M. A. F. Mennons.	1639. G. Ermen and R. Smith.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1174. F. A. Gatty.	1244. J. Meiklejon.
1297. F. A. Gatty.	1319. J. S. Crosland.

Registered Designs.

Portable Fire Engine—May 10—4710—Merryweather and Son, 63, Long-acre, and York-street, York-road, Lambeth, S.
Rack Pulley—May 15—4711—Messrs. C. and E. Gray, Birmingham.
Cleaning Rod for Small Arms—May 19—4712—Theophilus Murcote, 68, Haymarket.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, June 2, 1865. [No. 654. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Ordinary Meetings.

Wednesday Evenings at 8 o'clock.

June 7th.—*No Meeting.*—Owing to the Whitsun holidays and the consequent absence of many specially interested in the subject, it has been thought best to postpone the reading of Mr. Hawes's paper, "On the Policy of an Amalgamation of the Railways of the United Kingdom under Government Management," till next session.

Conversazione.

The Council have arranged for a Conversazione on Wednesday, the 14th June, at the South Kensington Museum, cards for which will shortly be issued.

Annual Conference.

The Fourteenth Annual Conference between the Council and the Representatives of the Institutions in Union and Local Boards will be held on Wednesday, the 14th June, at Twelve o'clock, noon. William Hawes, Esq., Chairman of the Council, will preside.

Secretaries of Institutions and Local Boards are requested to send, as soon as possible, the names of the Representatives appointed to attend the Conference.

The Council will lay before the Conference the Secretary's Report of the Proceedings of the Union for the past year, and the Results of the Examinations, as well as the Programme of Examinations, Elementary and Final, for 1866.

The following subjects are suggested for discussion:—

1. The establishment of organising teachers among the Institutes, on the plan adopted in the East Lancashire Union.
2. Is any modification of the present scheme of Elementary Examinations, by rendering it more adapted to the capacities of class pupils in Mechanics' Institutes, desirable?
3. The advantages of local prizes to successful candidates, at the Society of Arts' Examinations, as a stimulus to local competition.
4. Whether any special inducements can be held out to lead soldiers to avail themselves of the Society's Examinations?
5. The propriety of adding to the Society's Examinations the subject of "Practical Gardening," in accordance with a proposal made to the Council by the Royal Horticultural Society, who have expressed their willingness to offer prizes in this subject.
6. How can Institutions promote the Physical Education of their members?
7. How may Popular Readings and Entertainments be made to promote the efficiency of Institution Classes?
8. The advantage of Garden Allotments, as a feature of the Institute, with the view of healthful recreation for the members.
9. Should Institutes promote the establishment of Horticultural Shows, Building Societies, Penny Savings Banks, and similar movements towards the social amelioration of the people?
10. The advantages and disadvantages of subscriptions to Institutes being paid by weekly or other small amounts.

Notice should be given to the Secretary of the Society of Arts of any other subjects which Institutions or Local Boards may desire their Representatives to introduce to the notice of the Conference.

Representatives of Institutions and Local Boards attending the Conference are invited to the Society's Conversazione, at the South Kensington Museum, on the evening of the same day (14th June), and will receive cards on application at the Society's House, on the day of the Conference.

Secretaries of Institutions are requested to forward, *at once*, by book post, copies of the last Annual Reports of the Institutions.

International Exhibition of 1862.—Jury Reports.

The Council beg leave to announce that there are a small number of copies remaining of these Reports, which may now be had on application at the Society's House, price £1 5s. in cloth, or £1 11s. 6d. bound in morocco.

FINAL EXAMINATION, 1865.

PRIZES AND CERTIFICATES AWARDED TO CANDIDATES.

PRIZES.

His Royal Highness the Prince Consort's Prize of Twenty-five Guineas to

200—Thomas Healey, 25, of the Burnley Mechanics' Institution, book-keeper, who has obtained the following First-class Certificates :—

1862. Arithmetic—First-class Certificate.
,, English History—First-class Certificate, with Second Prize.
1863. Book-keeping—First-class Certificate.
1864. Algebra—First-class Certificate, with First Prize.
,, Mensuration—First-class Certificate, with Second Prize.
,, Chemistry—First-class Certificate, with Second Prize.
1865. Music—First-class Certificate, with First Prize.
,, Animal Physiology—First-class Certificate, with First Prize.

Arithmetic ...	1st Prize	£5	To No. 334—James Birch Brown, 20, Gilford Young Men's Mutual Improvement Society, clerk
	2nd Prize	3	,, 659—Thomas Hodgson, 16, City of London College, clerk
Book-keeping	1st Prize	5	,, 920—John Thomas Wright, 20, Werneth Mechanics' Institute, clerk
	2nd Prize	3	,, 1038—John Deane, 27, Salford Working Men's College, cashier
Algebra	1st Prize	5	,, 227—William Wilkins, 18, Chatham and Rochester, Strood and Brompton Mechanics' Institute, clerk
	2nd Prize	3	,, 697—James Rigby Smith, 24, City of London College, clerk
Geometry ...	1st Prize	5	,, 383—James Wade, 28, Glasgow Athenæum, cashier
	....	...	*No Second Prize awarded.**
Mensuration		...	*No Prizes awarded.†*
Trigonometry..............................		...	*No Prizes awarded.†*
Conic Sections............................		...	*No Prizes awarded.†*
Navigation & Nautical Astronomy ...	1st Prize	5	,, 307—Henry George White, 23, Devonport Mechanics' Institute, shipwright
	2nd Prize	3	,, 706—William Vaughan, 24, City of London College, clerk
Astronomy		...	*No Prizes awarded.†*
Principles of Mechanics ...	1st Prize	5	,, 706—William Vaughan, 24, City of London College, clerk
	....	...	*No Second Prize awarded.**
Practical Mechanics	....	...	*No Prizes awarded.†*
Electricity & Magnetism ..	1st Prize	5	,, 614—Herbert Burgess Brain, 24, City of London College, clerk
	2nd Prize	3	,, 344—William Arnot, 22, Popular Evening Classes, Andersonian University, Glasgow, manufacturing chemist
Light & Heat.	1st Prize	5	,, 342—William Barr, 20, Popular Evening Classes, Andersonian University, Glasgow, chemist
	2nd Prize	3	,, 755—James Sutherland Simon, 28, London Mechanics' Institution, clerk
Chemistry ...	1st Prize	5	,, 340—Edmund George Tosh, 18, Popular Evening Classes, Andersonian University, Glasgow, chemist.
	2nd Prize	3	,, 166—George Gillford, 18, Bristol Trade School, laboratory assistant
Mining and Metallurgy ..	....	...	*No Prizes awarded.†*
Botany.........	1st Prize	5	,, 1104—George Stanton, 24, Maidenhead Mechanics' Institution, gardener; together with the Royal Horticultural Society's Prize of £5
	....	...	*No Second Prize awarded.**
Agriculture...............................		...	*No Papers were worked in this subject.*
Animal Physiology (in relation to health)	1st Prize	5	,, 200—Thomas Hanley, 25, Burnley Mechanics' Institution, book-keeper
	2nd Prize	3	,, 76—Charles Taylor, 16, Banbury Mechanics' Institute, clerk
	3rd Prize‡	2	,, 1237—David Griffiths, 26, Leeds Mechanics' Institute, book-keeper
	....	...	*No additional Prizes of Books awarded.§*
Domestic Economy	1st Prize	5	,, 1336—Joseph Harrison, 23, Bradford Mechanics' Institute, clerk
	2nd Prize	3	,, 662—John Hughes, 21, City of London College, chemist's assistant

* No other Candidate obtained a First-class Certificate in these subjects.
† No Candidate obtained a First-class Certificate in these subjects.
‡ Additional by gift of Harry Chester, Esq.
§ No Book Prize in this subject was awarded, the only other Candidate who obtained a First-class Certificate being disqualified from receiving Prizes.

Political and Social Economy	....	...		*No Prizes awarded.*†
Geography	1st Prize	5	,,	281—Charles Jones Ellis, 25, Devonport Mechanics' Institution, shipwright in Her Majesty's Dockyard
	2nd Prize	3	,,	608—Henry Gurson Batley, 20, City of London College, clerk
English History	1st Prize	5	,,	699—William Spiers, 18, City of London College, clerk
	2nd Prize	3	,,	676—Hugh Morgan, 18, City of London College, banker's clerk
	3rd Prize¶	2	,,	632—Thomas William Davies, 22, City of London College, accountant
	Three Prizes of Books, to the value of £1 each¶	1	,,	383—James Wade, 28, Glasgow Athenæum, cashier
		1	,,	666—John Kennedy, 20, City of London College, clerk in Her Majesty's Customs
		1	,,	774—Thomas Davies, 21, St. Stephen's (Westminster) Evening School, Civil Service
English Literature	1st Prize	5	,,	686—Henry Thomas Pollard, 17, City of London College, clerk
	2nd Prize	3	,,	383—James Wade, 28, Glasgow Athenæum, cashier
	3rd Prize¶	2	,,	75—Arthur William Jakeman, 16, Banbury Mechanics' Institute, clerk
	One Prize of Books to the value of £1¶ ‖	1	,,	1219—William Todd, 18, Leeds Mechanics' Institute, woollen manufacturer
Logic & Mental Science	1st Prize	5	,,	1336—Joseph Harrison, 23, Bradford Mechanics' Institution, clerk
	2nd Prize	3	,,	716—Thomas Wilson, 23, Royal Polytechnic Local Board, clerk
Latin and Roman History	1st Prize	5	,,	1059—Edwin Law, 19, Salford Working Men's College, clerk
	2nd Prize	3	,,	588—Andrew Muirhead, 48, Leicester Church of England Institute, staff sergeant
French	1st Prize	5	,,	371—James Binnie, 20, Glasgow Athenæum, clerk
	2nd Prize	3	,,	9—James Tait, 22, Aberdeen Mechanics' Institution, clerk
German	1st Prize	5	,,	618—James Woodward Burke, 17, City of London College, commercial clerk
	2nd Prize	3	,,	549—Edward Konrad Reinold, Hull Young People's Christian and Literary Institute, engineer (apprentice)
Italian	1st Prize	5	,,	628—Samuel Court, 37, City of London College—in the Money Order Office, Lombard-street
	2nd Prize	3	,,	719—Annie Letitia MacKechnie, 29, Royal Polytechnic Institution
Spanish	1st Prize	5	,,	626—James Clayton, 31, City of London College, sorter, General Post-office
	2nd Prize	3	,,	687—William Price, 29, City of London College, clerk.
Free-hand Drawing	....	...		*No Prizes awarded.***
Geometrical Drawing	1st Prize	5	,,	140—Edwin Alexander Merry, 20, Bristol Trade School, architect's clerk
	2nd Prize	3	,,	1096—John Sargeant, 20, Slough Mechanics' Institution, carpenter
Theory of Music	1st Prize	5	,,	200—Thomas Healey, 25, Burnley Mechanics' Institution, book-keeper
	2nd Prize	3	,,	355—John Hunter Connell, 19, Popular Evening Classes, Andersonian University, Glasgow, clerk.

† No Candidate obtained a First-class Certificate in this subject.
¶ Additional, by gift of Sir C. Wentworth Dilke, Bart.
‖ The other Book Prizes in this subject were not awarded; the other Candidates obtaining First-class Certificates being disqualified from receiving Prizes.
** The only Candidate who obtained a First-class Certificate in this subject was disqualified from receiving Prizes.

CERTIFICATES.

The following is an Alphabetical List of the Candidates who have obtained Certificates :—

(1st) after a subject signifies a First-class Certificate.
(2d) ,, ,, Second-class ,,
(3d) ,, ,, Third-class ,,

(The occupations stated are either present or proposed.)

No.
602—Abell, Edward Garland, 16, City of London Coll., clerk—French (3d)
739—Absolon, William H. de Mansfield, 23, Royal Polytech. Inst., clerk—Bkpg. (1st)
445—Adam, John, 19, Glasgow M.I., mason—Arith. (2d); Bkpg. (2d)
1175—Adams, Frederick J., 19, West Bromwich Young Men's Christ. Inst., chemist and druggist—Chem. (3d)
1362—Adcock, John H., 17, Hackney Working Men's Institute, teacher—Arith. (1st); Alg. (3d)
731—Albin, Maria Juliette, 28, Royal Polytech. Inst.—Italian (3d)
83—Alderson, Emily, 27, Birmingham and Midland Inst., daily governess—German (3d); French (2d)
*84—Alderson, Louisa, 29, Birmingham and Midland Inst., daily governess—Eng. Lit. (3d)
21—Alexander, Henry, 23, Aberdeen M.I., engineer—Princ. Mech. (3d)
333—Alexander, Samuel, 18, Gilford Young Men's Mut. Imp. Soc., clerk—Arith. (2d)
*82—Alexander, William, 19, People's Reading Rooms, Belfast, teacher—Arith. (1st); English Hist. (2d); Geom. (2d): Alg. (3d)
1106—Allcott, James H., 21, Southampton Athenæum, officer of customs—Arith. (1st)
826—Alley, Peter Bradshaw, junr., 16, Manchester M.I., architect—Free-hd. Dwg. (2d)

*491—Anderson, James, 27, Glasgow M.I., clerk—Mens. (2d)
398—Anderson, (Miss) Stewart, 17, Glasgow Inst.—Bkpg. (3d)
85—Anderton, John G., 21, Birmingham and Midland Inst., optician—Light and Heat (2d)
199—Anningson, Joseph W., 18, Burnley M.I., druggist Anim. Phys. (2d)
362—Arbuckle, Hugh Wight, 18, Pop. Ev. Classes, Anders. Univ., Glasgow, student—Chemistry (2d)
992—Arbuckle, John, 19, Paisley Artizans' Inst., clerk (writer's)—Arith. (3d)
344—Arnot, William, 22, Pop. Ev. Classes, Anders. Univ., Glasgow—Elect. and Mag. (1st), with 2d prize; Chem. (2d)
33—Ashby, John Thomas, 18, Farnham Young Men's Inst., teacher—Arith. (2d); Eng. Lit. (1st); Free Hand Draw. (1st)
875—Ashmore, Isaac, 18, St. Thomas' Young Men's Christ. Inst., pupil teacher—Arith. (3d); Eng. Hist. (3d)
929—Ashton, Thomas, 23, Henshaw-street (Oldham) Mut. Imp. Soc., minder—Arith. (3d
930—Ashton, William, 24, Henshaw-street (Oldham) Mut. Imp. Soc., mechanic—Dom. Econ. (2d)
891—Ashworth, Henry, 20, Mossley M.I.—Bkpg. (1st)
797—Aspinall, George, 20, Manchester M.I., warehouseman—Bkpg. (1st)
796—Aspinall, John, 18, Manchester M.I., clerk—Bkpg. (1st)
1291—Aston, William, 31, Redditch Lit. and Sci. Inst., needle finisher—Anim. Phys. (3d)
86—Atkins, Alfred Hodgetts, 18, Birmingham and Midland Inst., pupil teacher—Chem. (2d)
262—Atkinson, John Ainscough, 22, Crewe M.I., post messenger—Arith (1st)
1032—Atkinson, John H., 19, Salford Working Men's Coll., merchant's clerk—German (2d)
209—Atkinson, Robert, 19, Burnley Ch. of Eng. Lit. Inst., roller coverer—Arith. (3d); Chem. (3d)
36—Attfield, Ernest, 17, Farnham Young Men's Inst., bank clerk—Bkpg. (3d)
325—Austin, Frederick, 17, Faversham Inst., clerk—Eng. Hist. (2d)

274—Bailey, George, 23, Devonport M.I., shipwright—Eng. Hist. (3d)
182—Bailey, John, 18, Nelson M.I. weaver—Anim. Phys. (3d)
942—Bailey, John Hyde, 17, Oldham Lyceum, bank clerk—Bkpg. (1st)
415—Baird, John, 22, Glasgow Inst., warehouseman—Free-hd. Dwg. (2d)
1369—Baker, Alfred B., 17, Lambeth Local Board, clerk—Arith. (2d)
753—Ballard, Elizabeth Ruth, 23, London M.I.—Eng. Lit. (3d)
28—Bank, George, 26, Accrington M.I., stoker—Arith. (3d)
1192—Banks, Joseph, 17, Wolverhampton W. Men's Coll., clerk—Arith. (1st)
605—Banister, Arthur, 19, City of London Coll., clerk—Bkpg. (1st)
178—Bannister, James, 26, Nelson M.I., warehouseman —Arith. (2d)
173—Barker, Charlotte S. M., 17, Bristol Ath.—Eng. Hist. (3d); French (2d)
606—Barker, Frank Cowlin, 19, City of London Coll., merchant's clerk—German (1st)
183—Barker, John, 22, Nelson M.I., weaver—Chem. (2d); Anim. Phys. (3d)
868—Barker, Miles, 22, Swinton M.I., colliery clerk—Arith. (2d); Mens. (3d)
1034—Barker, William T., 17, Salford W. M. Coll., warehouseman—Arith. (3d)
165—Barkla, William, 23, Bristol Ath., book-keeper—Arith. (3d); Bkpg. (2d)
607—Barlow, William, 32, City of London Coll., merchant's clerk—Bkpg. (2d)
237—Barlow, William Crosby, 28, Christchurch W.M. Inst., minister (teacher)—Botany (3d)
561—Barnes, Benjamin Thomas, 17, Ipswich W.M.C., clerk—Bkpg. (2d)
130—Barnes, Robert, 18, Bolton M.I., millwright—Free hd. Dwg. (3d)
342—Barr, William, 20, Pop. Evg. Classes, Anders. Univ., Glasgow, chemist—Light and Heat (1st) with 1st prize
47—Barr, William H., 20, Bacup M.I., druggist's assistant—Chem (2d); Anim. Phy. (3rd)
1227—Barrett, Arthur G., 18, Leeds M.I., clerk—Chem. (3d)
931—Barrow, Henry Mills, 22, Oldham Lyceum, attorney's clerk—Geom. Dwg. (3d)
583—Barron, Thomas H., 19, Leeds Y.M.C. Assoc., clerk—Arith. (2d)
1296—Bartleet, Charles, 16, Redditch Lit. and Sci. Inst., warehouseman—Bkpg. (3d)
87—Barwell, Sarah Maria, 16, Birm. and Midl. Inst.—French (3d)
843—Batchelor, Charles, 19, Manchester M.I., engineer —Geom. Dwg. (1st)
805—Bateman, Thomas, 21, Manchester M.I., clerk—Bkpg. (1st)
827—Bates, Arthur, 27, Manchester M.I., clerk—Bkpg. (1st); French (2d); Geom. Dwg. (3d)
497—Bates, John Dalton, 18, Halifax M.I., woolsorter—Bkpg. (2d)
1138—Batham, David, 17, Woodside Iron Works Imp. Soc., messenger—Arith. (3d)
608—Batley, Henry Gurson, 20, City of London Coll., clerk—Geog. (1st) with 2d prize.
88—Baylis, Thomas, 18, Birmingham and Midland Inst., leather dealer—Arith. (1st)
564—Beaumont, Barrington Gooding, 19, Ipswich Working Men's Coll., clerk—Bkpg. (1st)
980—Beedham, John, 23, Oldham Science School, surveyor's clerk—Geom. Dwg. (1st)
1108—Beer, Thomas, 25, Southampton Athenæum, clerk—Music (3d)
609—Begent, George T., 19, City of London College, clerk—Bkpg. (2d); Arith. (3d); Geog. (3d)
736—Belfrage, David McL., 30, Royal Polytech. Inst., clerk—Bkpg. (2d)
31—Bell Joseph, 17, Acomb Lit. Inst., clerk—Arith. (3d)
1165—Bennett, James, 27, Kinver Young Men's Assoc., carpenter—Geom. Dwg. (3d)
1142—Bennett, John, 23, Kinver Inst., registrar of births and deaths—Arith. (2d); Latin, &c. (3d)
154—Bennett, Philip, 16, Bristol Trade School, builder —Geom. Dwg. (1st)
890—Berry, Joseph, 33, Mossley M.I., warehouseman—Bkpg. (2d)
89—Best, Howard, 17, Birmingham and Midland Inst., die sinker—Elect. and Magn. (3d)
80—Best, James, 18, People's Reading Rooms, Belfast, assistant teacher—Arith. (3d); Mens. (3d)
751—Bickle, John, 23, London M.I., smith—Geog. (1st)
554—Biddles, Frederick J., 19, Hull Young People's Chr. and Lit. Inst., merchant's clerk—Arith. (3d); Eng. Hist. (3d); Geog. (2d)
1194—Bills, James, 22, Wolverhampton Working Men's Coll., clerk—Bkpg. (2d)
371—Binnie, James, 20, Glasgow Ath., clerk—Arith. (2d); Bkpg. (1st); French (1st) with 1st prize; Geog. (1st)
535—Bint, Charles Spencer, 21, Hertford, Lit. and Sci. Inst., solicitor's clerk—Arith. (3d); Bkpg. (2d)
352—Bishop, Thomas G., 19, Pop. Evg. Classes, Anders. Univ. Glasgow, clerk—Anim. Phys. (3d)

610—Bishop, William J., 17, City of London Coll., wholesale ironmonger—Spanish (3d); Music (3d)
560—Bixby, Robert, 28, Ipswich W.M.C., engineer's clerk—Bkpg. (1st)
470—Black, David, 16, Glasgow M.I., clerk—French (3d)
1105—Blake, Elizabeth, 21, Southampton Ath.—Eng. Hist. (2d); Geog. (2d); French (3d)
1308—Blanshard, William Noble, 20, York Inst., attorney's clerk—Arith. (1st); Bkpg. (2d); Alg. (3d)
852—Boardley, Samuel Batho, 17, Manchester M.I., clerk—Arith. (3d)
547—Bolton, Edward, 17, Hull Young Peoples' Christ. and Lit. Inst., clerk—Eng. Hist. (2d)
545—Bolton, George, 21, Hull Young Peoples' Christ. and Lit. Inst., clerk—German (3d)
35—Booker, George, 21, Farnham Young Men's Inst., assistant teacher—Geog. (2d)
3—Booth, William, 18, Aberdeen M.I., clerk—Arith. (2d)
500—Booth, William, 39, Halifax W.M.C., foreman in wool warehouse—Bkpg. (1st)
1322—Bottoms, Walker, 23, Wilsden M.I., power-loom weaver—Bkpg. (2d); Arith. (3d); Geog. (3d)
611—Boulton, Arthur H., 17, City of London Coll., clerk—Free-hand Dwg. (3d)
589—Bowmar, Alfred W., 17, Leicester Ch. of Eng. Inst., banker's clerk—Arith. (1st); Bkpg. (2d)
869—Bradbury, Edwin, 29, Freetown W.M. Inst., invoice clerk—Arith (3d); Bkpg. (2d)
940—Braddock, James, 18, Oldham Lyceum, clerk (gas office)—Arith (1st)
90—Bradley, Charles, 19, Birm. and Midl. Inst., chemist and druggist—(Chem. (2d)
1215—Bradley, John, 23, Wakefield M.I., millwright—Bkpg. (2d); Pract. Mech. (3d)
1035—Bradshaw, George, 16, Salford W.M. Coll., pupil teacher—Arith. (1st); Bkpg. (1st); Geog. (1st)
614—Brain, Herbert B., 24, City of London Coll., clerk—Elect and Magn. (1st) with 1st prize.
823—Bramall, William H., 19, Manchester M.I., brass finisher—Geom. Dwg. (3d)
758—Bramham, William, 20, St. Michael's (Bromley) Evg. Classes, engineer and millwright—Arith. (3d)
501—Brearley, Thomas, 18, Halifax W.M.C., pupil teacher—Arith. (3d); Eng. Lit. (2d)
502—Brearley, William H., 19, Halifax W.M.C., bookkeeper—Bkpg. (1st); Arith. (3d)
68—Brereton, Richard, 23, Banbridge Lit. and Mut. Imp. Inst., schoolmaster—Arith. (1st); Eng. Hist. (3d); Geom. (3d)
538—Briden, George, 19, Hertford Lit. and Sci. Inst., baker—Bkpg. (2d)
206—Bridge, Thomas, 17, Burnley Ch. of Eng. Inst., weaver—Arith. (3d); Bkpg. (2d)
*528—Briggs, James Rhodes, 39, Halifax W.M.C., bookkeeper—Bkpg. (1st)
1212—Briggs, Thomas, 18, Wakefield, M.I., clerk—Bkpg. (2d)
795—Britton, William, 32, Manchester M.I., warehouseman—Bkpg. (2d)
806—Britton, William H., 18, Manchester M.I., maker-up—Arith. (3d)
40—Broad, Henry, 17, Farnham, pupil teacher—Arith. (3d); Eng. Hist. (3d); Geog. (2d)
944—Brooks, Peter, 19, Oldham Lyceum, brickmaker—Arith. (2d)
804—Brooks, Richard H., 17, Manchester M.I., clerk—Bkpg. (1st)
1260—Broughton, Zachariah, 16, Woolwich Sci. Sch., fitter and turner—Geom. Dwg. (2d)
345—Brown, Andrew, 23, Pop. Evg. Classes, Anders. Univ. Glasgow, warehouseman—Anim. Phy. (3d)
477—Brown, Andrew, 17, Glasgow M.I., bookeeper and cashier—Eng. Lit. (2d)
615—Brown, Benjamin, 20, City of London Coll., clerk—Arith. (3d)
1180—Brown, David, 26, Willenhall Lit. Inst., colliery clerk—Arith. (1st)
996—Brown, Hugh, 16, Paisley Artizans' Inst., clerk—Arith. (2d); Mens. (3d)
334—Brown, James Birch, 20, Gilford Young Men's Mut. Imp. Soc., clerk—Arith (1st) with 1st prize
360—Brown, John, 24, Pop. Evg. Classes, Anderson Univ., Glasgow, building surveyor's assistant—Anim. Phys. (2d); Mens. (3d)
991—Brown, Neil, 16, Paisley Artizans' Inst., engineer—Arith. (3d)
1199—Brown, Thomas, 32, Wolverhampton Working Men's Coll., agent—German (2d)
359—Brown, William, 17, Pop. Evg. Classes, Anderson Univ., Glasgow, pupil teacher—Eng. Hist. (2d); Anim. Phys. (2d)
616—Browne, Walter P., 20, City of London College, merchant's clerk—Spanish (3d)
205—Broxup, James, 23, Burnley Ch. of Eng. Inst., mechanic—Bkpg. (2d)
367—Buchanan, David, 18, Glasgow Ath., clerk—Bkpg. (1st)
399—Buchanan, Gavin, 18, Glasgow Inst., assistant registrar of births, &c.—Arith. (2d); Bkpg. (2d)
904—Buckley, Abel, 25, Mossley M.I., teacher—Bkpg. (2d); Anim. Phys. (3d)
217—Buckley, Benjamin, 21, Bury Ath., dentist—Chem. (3d)
1036—Buckley, Edwin, 18, Salford Working Men's Coll., pupil teacher—Arith (2d); Geog. (3d)
906—Buckley, Robert, 20, Mossley M.I., cotton piecer—Bkpg. (2d)
617—Bull, Edward Philos, 25, City of London College, clerk—Bpkg. (1st)
578—Bumby, Thomas, 18, Leeds Young Men's Chr. Assoc., warehouseman—Bkpg. (1st)
1109—Burge, Charles H., 18, Southampton Ath., school assistant—Arith (1st); Eng. Hist. (2d)
618—Burke, James Woodward, 17, City of London College, commercial clerk—German (1st) with 1st prize
275—Burner, William H., 17, Devonport M.I., engineer (student)—Arith (2d); Algebra (3d)
37—Burningham, James Winkworth, 17, Farnham Young Men's Inst., clerk—Bkpg. (3d)
411—Burnside, Robert, 19, Glasgow Inst., upholsterer—Free-hd. Dwg. (3d)
276—Burt, Henry, 17, Devonport M.I., engineer (student)—Alg. (2); Arith. (3d); Mens. (3d)
277—Burt, John, 26, Devonport M.I., shipwright—Arith. (2d); Alg. (1st)
1279—Burton, John, 25, Woolwich Sci. Sch., cast-iron moulder—Geom. Dwg. (3d)
548—Burwell, George, 19, Hull Young People's Inst., clerk to merchant grocer—French (3d)
551—Burwell, William, 18, Hull Young People's Inst., merchant's clerk—German (2d)
1265—Busbridge, Walter, 25, Woolwich Sci. Sch., draughtsman—Geom. Dwg. (2d)
278—Butler, Richard Jago, 16, Devonport M.I., engineer (student)—Arith. (3d); Alg. (3d)

815—Cadley, George, 22, Manchester M.I., boot closer—Alg. (2d)
1243—Caldwell, Joseph, 18, Leeds M.I., clerk—Arith. (3d)
619—Callanan, John, 25, City of London College, carpenter—Arith. (2d); Alg. (2d)
448—Callander, John, 18, Glasgow M.I., warehouseman—Arith. (3d)
840—Calvert, Charles, 17, Manchester M.I., engineer—Arith. (2d)

348—Campbell, Archibald, 23, Pop. Evg. Classes, Anders. Univ. Glasgow, chemist—Chem. (1st)
621—Cannon, George, 23, City of London Coll., insurance clerk—Bkpg. (2d)
279—Canter, George C., 18, Devonport M.I., shipwright (apprentice)—Arith. (1st); Eng. Hist. (2d); Alg. (2d); Mens. (2d)
429—Carswell, Robert, 23, Glasgow M.I., clerk—Arith. (1st); Anim. Phy. (2d)
622—Carter, William, 23, City of London Coll., mercantile clerk—Bkpg. (1st)
1134—Cartwright, John, 16, Woodside Y. Men's Mut. Imp. Soc., pupil teacher—Arith. (3d)
1176—Cashmore, William Whitehouse, 19, West Bromwich, Y. Men's Christian. Inst., iron merchant's clerk—Chem. (3d); Geog. (2d)
559—Cattermole, Charles Moyse, 16, Ipswich W.M.C., attorney's clerk—Bkpg. (2d)
232—Cearns, John F., 18, Chatham, &c., M.I., shipwright (apprentice)—Arith (2d); Alg. (2d); Con. Sect. (3d); Mens. (3d)
945—Chadwick, Thomas H., 22, Oldham Science Sch., book-keeper—Geom. Dwg. (2d)
266—Chambers, William, 23, St. John's (Deptford) Evg. Classes, engineer—Alg. (3d)
336—Chambers, William, 23, Gilford Y. Men's Mut. Imp. Soc., teacher—Arith. (2d)
1325—Chambers, William, 18, Blackburn M.I., weaver—Arith (2d)
777—Champion, William, 20, St. Stephen's (Westmr.) Evg. School, clerk—Bkpg. (2d)
539—Chandler, Frederic, 18, Hertford, Lit. and Sci. Inst., teacher—Arith. (1st); Bkpg. (1st)
789—Chantry, Lucy, 23, Macclesfield Use. Know. Soc., housekeeper—Dom. Econ. (3d)
1154—Chapman, Garmston Percy, 30, Stourbridge Inst., accountant—Arith. (2d); Bkpg. (2d)
623—Chapman, James Albert, 24, City of London Coll., clerk—Bkpg. (1st); Geog. (3d)
624—Cheese, Clement Baillie, 17, City of London Coll., clerk—Bkpg. (2d)
955—Cheetham, Ralph, 20, Oldham Science School, book-keeper—Geom. Drawing (2d)
1009—Christie, Thomas, 25, Paisley Artizan's Institute, cloth cutter—Music (2d)
1183—Clark, John, 19, Willenhall Lit. Inst., attorney's articled clerk—Arith. (1st)
272—Clark, Robert, 18, Deptford Local Board, shipwright—Arithmetic (2d); Geom. (3d)
280—Clark, Robert G., 26, Devonport M.I., shipwright —Bkpg. (2d); Alg. (2d)
625—Clarke, George, 22, City of London Coll., clerk—Arith. (1st); Free-hand Dwg. (2d)
764—Clarke, Robert, 46, St. Michael's (Bromley), Evg. Classes, grocer—Bkpg. (2d)
756—Clarke, Robert Scott, 19, St. Michael's (Bromley), Evening Classes, storekeeper's clerk—Arithmetic (1st); Bkpg. (1st)
872—Clayton, Benjamin, 27, Christ Church (Hulme) Inst., coach trimmer—Bkpg. (2d)
1171—Clayton, Edward, 16, Messrs. Bagnall's Sch., Gold's Hill—pupil teacher—Arith. (2d); Latin, &c., (2d); Eng. Hist. (3d)
626—Clayton, James, 31, City of London Coll., sorter in the Gen. Post-office—Spanish (1st), with 1st prize.
863—Clayton, Joseph, 27, Christ Church (Hulme) Inst., coach body maker—Arith. (3d)
871—Clayton, Wm. Henry, 20, Christchurch (Hulme) Inst., warehouseman—Spanish (1st); French (2d); Arith. (3d); Music (3d)
201—Clegg, James, 21, Burnley Ch. of Eng. Inst., mule spinner—Arith. (3d); Chem. (3d)
180—Clegg, Samuel, 21, Nelson M.I., weaver—Chem. (3d)
627—Clementson, Alfred Bland, 24, City of London Coll., clerk—Dom. Econ. (2d)
880—Clemitson, William, 23, Middlesbro' M.I., engineer—Chem. (2d)
170—Clifft, James Willington, 20, Bristol Trade Sch., perfumer—Chem. (3d)
1031—Close, John, 16, Reeth M.I.—Geog. (3d)
1333—Clough, William H., 19, Bradford M.I., stationer—Bkpg (2d); Alg. (3d); Geog. (1st)
1253—Coates, Charles, 18, Whitby M.I., attorney's clerk —Eng. Hist. (2d); Eng. Lit. (2d)
503—Coates, Joseph, 19, Halifax W.M.C., apprentice joiner—Bkpg. (2d)
926—Coates, Thomas, 17, Oldham Analytic and Lit. Inst., mechanic—Geom. Dwg. (2d)
483—Coats, William A., 19, Glasgow M.I., clerk—Bkpg. (2d)
531—Cocks, John, 24, Haughton Dale Educ. Inst., clerk —Arith. (1st); Pol. Econ. (3d); Mens. (3d)
575—Coe, Owen, 16, Ipswich W.M. Coll., photographer's assistant—Bkpg. (1st); French (3d)
271—Coles, John Lemuel, 18, Deptford Local Board, shipwright—Geom. (3d)
151—Collens, Edward, 22, Bristol Trade School, chemist (analytical)—Geom. Dwg. (2d); Anim. Phy. (2d)
876—Collier, Alfred, 24, Christ Church (Hulme) Inst., clerk—Arith. (3d)
1037—Collinge, Samuel, 23, Salford W.M. Coll., clerk—Bkpg. (2d)
785—Collins, Albert, 20, Macclesfield, Use. Know. Soc., railway clerk—French (3d)
820—Collins, John, 16, Manchester M.I., silversmith—Bkpg. (3d)
94—Collins, Joseph, 17, Birm. and Midl. Inst., die sinker—Eng. Lit. (2d)
444—Colquhoun, James, 18, Glasgow M.I., sailmaker—Arith. (3d)
355—Connell, John Hunter, 19, Pop. Evg. Classes, Anders. Univ. Glasgow, clerk—Music (1st) with 2nd prize
1011—Connor, John, 37, Paisley Artizan's Inst., carpet weaver—Music (2d)
1086—Cook, William J., 16, Scarboro' M.I.—Arith. (3d); Eng. Hist. (3d); Latin (2d)
161—Coomber, George, 16, Bristol Trade School, engineer apprentice—Geom. Dwg. (3d)
1241—Cooper, Isabella M., 24, Leeds M.I.—German (2d)
887—Cooper, Thomas Dawson, 20, Middlesbro' M.I., surveyor—Free-hand Dwg. (3d)
1152—Cotterell, John, 21, Messrs. Chance's Lib., glass painter—Free hand Dwg. (2d)
628—Court, Samuel, 37, City of London Coll., in Money Order Office, Lombard-street—Italian (1st) with 1st prize
270—Courtney, Joseph W., 16, St. John's (Deptford) Evg. Classes, clerk—Arith. (3d)
133—Cowley, Thomas, 35, Holy Trinity (Bolton) W.M. Inst., clerk—Anim. Phy. (3d)
595—Cox, Thomas, 17, Lichfield W.M. Inst., brewer's clerk—Bkpg. (1st)
629—Cox, William, 18, London Y.M. Christ. Assoc., clerk—Arith. (3d); Bkpg. (1st)
1304—Crament, John M., 19, York Inst., usher—Eng. Lit. (1st); Arith. (2d); Geog. (2d).
424—Cranston, Alexander, 17, Glasgow M.I., clerk—Bkpg. (1st)
95—Cresswell, Alfred, 25, Birmingham and Midland Inst., builder—Elect and Magn. (3d)
1091—Crosland, William, 28, Selby M.I., auctioneer—Bkpg. (2d)
193—Crossley, Jonas, 18, Burnley M.I., weaver—Bkpg. (2d)
233—Crusha, David T., 17, Chelmsford, L. and M.I., pupil teacher—Arith. (2d)
630—Crutch, Francis Gage, 19, City of London Coll., clerk—Bkpg. (1st)
246—Cuff, Frank, 23, Christchurch W.M. Inst., mercantile clerk—Arith. (2d); Chem. (2d)

529—Cullwick, Benjamin, 27, Hastings M.I., watchmaker—Arith. (3d); Eng. Hist. (2d)
1270—Cumming, Douglas G., 19, Woolwich Sci. Sch., turner and fitter—Geom. Dwg. (2d)
631—Curtis, Edwin R., 20, City of London Coll., shipbrokers' clerk—French (3d)
1301—Cuthbert, George, 19, York Inst., shoemaker—Book-keeping (2d)
380—Cuthbertson, Thomas, jun., 17, Glasgow Ath., clerk—French (3d)
1163—Dakin, Edwin A., 19, Stourbridge Ch. of Eng. Y. Men's Assoc., clerk—Arith. (2d)
550—Dalton, Edwin J., 16, Hull Young People's Ch. and Lit. Inst., clerk—Arith. (3d); Eng. His. (3d)
172—Daniel, Atchason, 31, Bristol Ath. upholsterer and house agent—Book-keeping (2d)
139—Daniel, George H., 20, Bristol Mining School, mining surveyor—Geom. Dwg. (1st)
1372—Darley, W. H., 16, Alton M.I., turner, &c.—Geog. (2d)
1250—Dawson, Thomas, 16, Leeds School of Art, clerk—Free-hd. Dwg. (3d)
1027—David, Peter George, 17, Pembroke Dock M.I., pupil teacher—Arith. (3d); Geog. (2d)
253—Davies, Alfred H., 18, Crewe M.I., apprentice fitter—Arith. (3d); Bkpg. (2d)
1193—Davies, James, 19, Wolverhampton Working Men's Coll., clerk—Arith. (3d); Bkpg. (2d)
774—Davies, Thomas, 21, St. Steven's (Westminster) Evg. School, Civil Service—Arith. (1st); Eng. Hist. (1st) with book prize; Geog. (1st)
948—Davies, Thomas, 23, Oldham Science School, mechanic—Geom. Dwg. (2d)
632—Davies, Thomas W., 22, City of London Coll., accountant—Eng. Hist. (1st), with 3d prize.
1040—Davies, William, 16, Salford Working Men's Coll., clerk—Bkpg. (1st); Arith. (2d)
1135—Davies, William, 17, Woodside Young Men's Mut. Imp. Soc., pupil teacher—Arith. (2d)
837—Davis, David, 17, Manchester M.I.—Arith (3d)
983—Davis, Samuel, 22, Oldham Science School, tinplate worker—Geom. Dwg. (2d)
633—Day, Thomas J., 25, City of London Coll, clerk—Bkpg (2d)
1038—Deane, John, 27, Salford Working Men's Coll., cashier—Bkpg (1st) with 2d prize; French (2d)
634—Dear, George A., 24, City of London Coll., clerk—Bkpg. (1st)
835—Dearman, Wilfred Huitson, 18, Manchester M.I., mechanic—Geom. Dwg. (3d)
598—Deller, William, 18, Lichfield Working Men's Inst., proctor's clerk—Bkpg. (2d)
450—Dempster, James Keith, 26, Glasgow M.I., architectural draughtsman—Botany (3d)
426—Dempster, Samuel Watson, 22, Glasgow M.I., clerk—Eng. Lit. (3d)
635—Dickinson, George, 20, City of London Coll., chemist's assistant—Bkpg. (1st)
349—Dickson, James, junr., 26, Pop. Eng. Classes, Anders. Univ., Glasgow, clerk—Light and Heat (2d)
331—Doak, William, 18, Gilford Young Men's Mutual Imp. Soc., clerk—Arith. (3d)
1251—Dobell, Douglas D., 20, Whitby M. I., assistant clerk to comm. of taxes—Geog. (1st); Eng. Hist. (2d); Pol. Econ. (3d)
636—Dobell, Richard, 23, City of London Coll., clerk—Arith. (1st); Bkpg. (1st)
504—Dobson, Charles, 18, Halifax W. M. C., railway clerk—Bkpg. (1st)
1088—Dobson, Goland Burton, 16, Scarboro' M. I., sailor—Arith. (1st)
849—Dodd, John, 22, Manchester M. I., clerk—Bkpg. (1st)
194—Dodgson, William, 19, Burnley M. I., engineer—Arith. (2d); Mens. (3d)
1101—Dorrell, Henry B., 18, Slough M. I., carpenter—Geom. Dwg. (2d); Free-hand Dwg. (2d)
328—Douds, John, 26, Gilford Young Men's Mut. Imp. Soc., teacher—Arith. (3d)
137—Douglas, Alfred J., 16, Bristol Trade School, fitter—Geom. Dwg. (3d)
8—Dow, Thomas, 23, Aberdeen M.I., blacksmith—Eng. Hist. (2d)
1274—Downar, George F., 20, Woolwich Sci. Sch., clerk—Chem. (3d)
1167—Drew, Samuel, jun., 19, Walsall Ch. Inst., butcher—Alg. (1st); Bkpg. (2d)
956—Dronsfield, William, 19, Oldham Science School, mechanic—Geom. Dwg. (3d)
486—Drummond, Alexander, 20, Glasgow M.I., clerk—Arith. (3d); Eng. Hist. (2d)
1—Drummond, James, 18, Aberdeen M.I., clerk—French (3d)
1014—Drummond, John, 20, Paisley Artizans' Inst., engineer—Music (3d)
1145—Duffell, John, 18, Messrs. Chance's Library, clerk—Arith. (2d)
1186—Duffield, Thomas H., 43, St. Peter's Night School (Wolverhampton), certificated teacher—Eng. Hist. (2d); Eng. Lit. (2d)
443—Duncan, William J., 19, Glasgow M.I., accountant's clerk—Arith. (2d)
572—Duningham, Albert Holmes, 21, Ipswich, merchant's clerk—Bkpg. (2d)
400—Dunlop, William, 18, Glasgow Inst., bookseller—Bkpg. (1st)
393—Duthie, George, 21, Glasgow Ath., insurance clerk—Bkpg. (1st)

247—Edey, George, 18, Christchurch W. M. Inst., chemist's assistant—Chem. (3d)
637—Edmonds, John Thomas, 20, City of London Coll., clerk—French (3d); Logic, &c. (3d)
638—Edwards, Edwin, 18, City of London Coll., clerk—Arith. (3d)
1196—Edwards, John, 21, Wolverhampton W. Men's Coll., clerk—Bkpg. (1st)
1041—Edwards, Richard, 23, Salford W. M. Coll., clerk—Bkpg. (2d)
382—Edwards, Thomas, 27, Carlton-place Secular Sch., Glasgow, teacher—Min. and Met. (3d)
1022—Edwards, Thomas, 20, Pembroke Dock M.I., shipwright—Geog. (2d)
1042—Edwards, Thomas, 31, Salford W.M. Coll., warehouseman—Bkpg. (2d)
229—Ellington, Charles T., 18, Chatham, &c., M.I., pupil teacher—Arith. (1st); Alg. (1st); Geog. (2d)
857—Elliott, Thomas Griffin, 16, Manchester M.I., engineer—Arith. (1st); Chem. (2d)
281—Ellis, Charles Jones, 25, Devonport M.I., shipwright—Geog. (1st), with 1st prize
639—Ellis, James F., 17, City of London Coll., lithographer—Arith. (1st); French (3d)
282—Ellis, Richard J., 20, Devonport M.I., shipwrights' apprentice—Bkpg. (2d); Princ. Mech. (2d)
768—Ellis, Walter J., 16, St. Stephen's (Westminster) Evening School, pupil teacher—Arith. (2d); Geog. (3d)
1225—Elmsley, Thomas, 22, Leeds M.I., weaver—Arith. (2d)
781—Elsom, Albert, 18, Louth M.I., pupil teacher—Arith. (1st)
123—Entwistle, Robert, 29, Bolton M.I., book-keeper—Chem. (2d)
867—Etock, Charles, 17, Chancery-lane (Ardwick) Inst., warehouseman—Arith. (2d)
167—Evans, Benjamin, 16, Bristol Ath., accountant's clerk—Bkpg. (2d)
733—Evans, George, 26, Royal Polytech. Inst., butcher Arith. (2d); Dom. Econ. (2d)

780—Farrah, William H., 28, Louth M.I., schoolmaster—Arith. (1st)
1349—Fearnside, Henry, 19, Bradford M.I., invoice clerk—Arith. (2d)
999—Ferguson, William, 26, Paisley Artizan's Inst., block printer—Music (3d)
163—Fiddes, Walter W., 19, Bristol Trade School, engineer—Chem. (2d); Anim. Phy. (2d)
1344—Field, George H., 19, Bradford M.I., printer—English Hist. (2d); Geog. (3d)
1338—Fielding, John, 17, Bradford M.I., clerk—Arith. (2d)
584—Findley, George W., 19, Leicester Ch. of Eng. Inst., bookseller—Logic, &c. (2d)
1331—Firth, James, 19, Bradford M.I., railway clerk—Arith. (2d); Geom. (3d); Alg. (3d)
283—Ford, Francis, 17, Devonport M.I., engineer (student—Arith. (3d); Alg. (3d)
213—Foulds, Thomas, 20, Burnley M.I., warehouseman—Arith. (3d)
596—Fowler, John, 28, Lichfield W. M. Assoc., grocer's assistant—Bkpg. (2d)
760—Foxton, William T., 28, St. Michael's (Bromley) Evg. Classes, porter—Bpkg. (2d)
749—Francis, Joseph, 19, London M.I., engineer—Geom. Dwg. (2d)
74—French, Alfred, 25, Banbury M.I., baker—Botany (2d)
353—French, Andrew, 26, Pop. Evg. Classes, Andersonian Univ., Glasgow, enginekeeper—Light and Heat (1st)
1286—Frost, Reuben Cæsar, 21, Woolwich Sci. Sch., labourer—Geom. Dwg. (2d)
1102—Fryer, Thomas, 19, Slough M.I., clerk—Geom. Dwg. (1st)
1112—Fulton, William, 33, Southampton Athen., grocer—French (3d)

438—Galbraith, Robert, 21, Glasgow M.I., mechanic—Arith. (2d)
642—Gale, Samuel R., 21, City of London Coll., merchant's clerk—Bkpg. (1st)
322—Gamman, Francis, 19, Faversham Inst., accountant—Arith (2d)
643—Gardiner, William, 28, City of London Coll., registrar to a public company—French (3d)
1275—Gardner, Charles Robert, 17, Woolwich Sci. Sch., iron turner, (apprentice)—Geom. Dwg. (2 d)
597—Gardner, Thomas, 30, Lichfield W.M. Assoc., National schoolmaster—Bkpg. (1st); Eng. Lit. (1st)
644—Garrett, George W., 22, City of London Coll., commercial clerk—Eng. Hist. (3d); Logic, &c. (2d)
645—Garside, Edwin S., 18, City of London Coll., clerk—Arith (1st)
505—Garside, John, 21, Halifax W.M.C., power-loom overlooker—Bkpg. (1st)
935—Gartside, Samuel, 25, Oldham Science and Art Sch., iron turner—Geom. Dwg. (2d)
954—Gartside, Samuel, 21, Oldham Science School, stonemason—Geom. Dwg. (2d)
354—Gavin, James Adam, 20, Pop. Evg. Classes, Anders. Univ., Glasgow, clerk—Bkpg. (1st)
901—Gee, Henry, 19, Mossley M.I., power-loom weaver—Bkpg. (3d)
381—Gibbon, Samuel, 24, Glasgow Ath., book-keeper—French (2d)
73—Gibbs, Fanny, 17, Banbury M.I., pupil teacher—Dom. Econ. (1st); Anim. Phy. (1st)
224—Gibson, Joseph, 22, Carlisle M.I., post-office clerk—Arith. (3d)
646—Gilbert, William C., 18, City of London Coll., clerk—Alg. (2d)
45—Giles, Richard Robert, 16, S.E. Railway M.I., Ashford, railway clerk—Arith. (2d)
1010—Gill, James, 21, Paisley Artizan's Inst., shawl pattern designer—Music (2d); Free-hand Dwg. (3d)
166—Gillford, George, 18, Bristol Trade School, laboratory assistant—Chem. (1st), with 2d prize
591—Gladman, John T. H., 16, Lichfield W. Men's Assoc., bandsman—Music (2d)
506—Glasby, Charles Johnson, 16, Halifax W.M.C., maker-up—Bkpg. (2d)
877—Godward, Edward, 23, New Mills W. Men's Inst., spinner—Arith. (1st)
1198—Golby, Thomas, 17, Wolverhampton W. Men's Coll., clerk—Arith. (2d)
1005—Goldie, James, 26, Paisley Artizans' Inst., joiner—Music (3d)
585—Goodger, William C., 17, Leicester Ch. of Eng. Inst., clerk—Arith. (3d)
284—Goodyear, Thomas H., 18, Devonport M.I., engineer (student)—Trig. (2d); Alg. (2d); Mens. (3d)
786—Gordon, Joel, 23, Macclesfield Use. Know. Soc., silk sizer—Eng. Hist. (3d)
251—Gornall, James, 19, Clitheroe M.I., spinner—Arith. (3d)
249—Gornall, John, 23, Clitheroe M.I., cotton spinner—Arith. (3d); Geog. (3d)
1283—Gorrie, Daniel, 27, Greenwich Sci. Sch., joiner—Geom. Dwg. (2d)
221—Gott, Edwin, 25, Calverley M.I., woollen-cloth weaver—Bkpg. (2d); Arith. (3d); Geog. (3d)
1276—Gould, Charles, 17, Woolwich Sci. Sch., lad in R. Arsenal—Geom. Dwg. (3d)
1216—Grace, John A., 16, Wakefield M.I., clerk—Arith. (2d)
456—Graham, Robert, 18, Glasgow M.I., in a wholesale news-agents' office—French (3d)
225—Graham, William, 18, Carlisle M.I., clerk—Arith. (3d)
285—Grant, Richard S., 20, Devonport M.I., shipwright apprentice—Arith. (1st); Alg. (2d)
210—Grant, Wm. Lewis, 16, Burnley Ch. of Eng. Lit. Inst., at school—Arith. (2d); Chem. (3d); Free-hand Dwg. (3d)
1095—Grantham, Henry, 25, Slough M.I., coach builder—Free-hand Dwg. (3d)
1002—Gray, Matthew, 22, Paisley Artizans' Inst., schoolmaster—Music (3d)
1315—Green, Bernard, 21, Haslingden M.I., piece looker—Arith. (1st)
1246—Green, Thos. W., 26, Leeds Church Inst., clerk—Bkpg. (2d)
1361—Greenfield, Philip, 21, Hackney W. Men's Inst., teacher—Arith. (1st); Bkpg. (2d); French (3d)
207—Greenhalgh, William, 18, Burnley Lit. Inst., pupil teacher—Anim. Phy. (3d)
532—Greenwood, Edwin, 25, Hatherlow M.I., wire-drawer—Bkpg. (2d)
27—Greenwood, Holmes, 17, Accrington M.I., warehouseman—Arith. (2d)
810—Greenwood, William H., 19, Manchester M.I., salesman—Mining and Met. (2d); Bkpg. (1st)
734—Greig, Alfred, 16, Royal Polytech. Inst., clerk—Bkpg. (2d)
1045—Gretton, John Jenkins, 17, Salford Working Men's Coll., clerk—Arith. (2d); Bkpg. (2d)
1237—Griffiths, David, 26, Leeds M.I., book-keeper—Anim. Phys. (1st), with 3rd prize; Chem. (2d)
1024—Griffiths, Henry, 23, Pembroke Dock M.I., shipwright—Arith. (1st); Eng. Hist. (2d); Geog. (2d)
1043—Griffiths, John, 17, Salford Working Men's Coll., railway clerk—Bkpg. (2d); Arith. (3d)
808—Griffiths, John A., 17, Manchester M.I., engineer—Chem. (1st); Elect. and Magn. (2d); Anim. Phys. (2d); Princ. Mech. (3d)

157—Griffiths, William, 16, Bristol Min. School, mining engineer—Geom. Dwg. (3d)

42—Griffiths, William Holsey, 16, South-Eastern Rail. M.I., Ashford, railway clerk—Arith. (1st)

576—Grimwade, John H., 16, Ipswich Working Men's Coll., woollen draper—Eng. Hist. (3d)

258—Gubbins, Edwin, 18, Crewe M.I., pupil teacher—Arith. (2d)

1238—Guest, Thomas, 17, Leeds M.I., clerk—Chem. (2d)

1292—Guise, William, 36, Redditch Lit. and Sci. Inst., needle hardener—Anim. Phys. (3d)

1233—Gurney, James, 19, Leeds M.I., soap manufacturer—Chem. (2d)

1206—Hadfield, James, 18, Staleybridge M.I., cotton piecer—Arith. (3d)

318—Hainsworth, David, 16, Farsley M.I., clothier—Arith. (3d)

1181—Hall, Henry, 17, Willenhall Lit. Inst., upholsterer—Arith. (3d)

648—Halsey, William, 20, City of London Coll., clerk—Arith. (2d)

392—Hamilton, Archibald, junr., 18, Glasgow Ath., cashier—Bkpg. (1st)

1115—Hamilton, James T., 16, Southampton Ath., clerk—Arith. (3d)

1116—Hamilton, William F., 17, Southampton Ath., clerk—Arith. (2d)

649—Harding, James Staughton, 25, City of London Coll., clerk—German (2d)

198—Hargreaves, Edmund, 19, Burnley M.I., weaver—Arith. (2d); Anim. Phy. (2d)

54—Hargreaves, Henry, 20, Bacup M.I., weaver—Arith. (3d)

1252—Harland, William, 18, Whitby M.I., teacher—Arith. (3d); Free-hand Dwg. (3d)

1340—Harley, George, 25, Bradford M.I., clerk—Eng. Hist. (2d)

1204—Harley, William, 20, Wolverhampton W. Men's Coll., attorney's clerk—Free-hand Dwg. (3d)

507—Harling, James, 25, Halifax W.M.C., book-keeper—Bkpg. (2d)

236—Harris, Charles, 19, Chelmsford L. and M. Inst., pupil teacher—Arith. (3d); Eng. Hist. (3d); Free-hand Dwg. (2d)

650—Harris, Morris, 26, City of London Coll., clerk—Arith. (1st); Bkpg. (1st)

824—Harrison, John B., 32, Manchester M.I., railway clerk—French (3d)

212—Harrison, Horatio, 18, Burnley Ch. of Eng. Inst., gardener—Chem. (3d)

1336—Harrison, Joseph, 23, Bradford M.I., clerk—Arith. (1st); Dom. Ecom. (1st) with 1st prize; Logic, &c. (1st) with 1st prize

943—Harrison, Joseph E., 17, Oldham Lyceum, draughtsman—French (3d)

946—Harrison, Joseph E., 17, Oldham Science School—Geom. Dwg. (1st)

714—Harrison, Walter H., 18, R. Polytechnic Local Board—Alg. (2d)

499—Hartley, Anthony, 18, Halifax M.I., warehouseman—Bkpg. (2d)

874—Hartley, Joseph, 24, Christ Church (Hulme) Inst., in chemical works—Arith (3d); Chem. (3d)

131—Harwood, Robert, 30, Bolton M.I., engineer—Chem. (2d)

97—Haseler, George Carter, jun., 19, Birm. and Midl. Inst., jeweller—Light and Heat (3d); Chemistry (3d)

651—Hatch, John J., 20, City of London Coll., correspondent and book-keeper—Arith. (2d); Eng. Hist. (1st)

147—Hatton, Henry, 21, Bristol Trade School, attorney's clerk—Geom. Dwg. (3d)

1026—Hays, George, 17, Pembroke Dock M.I., pupil teacher—Arith. (1st); Geog. (1st)

652—Hayward, Henry, 24, City of London Coll., printer's reader—German (2d); French (2d)

653—Hayward, James, 21, Croydon L. and S.I., warehouseman's assistant—Bkpg. (2d); Arith. 3d))

654—Hazelton, Philip, 16, City of London Coll., clerk—Arith. (1st)

200—Healey, Thomas, 25, Burnley M.I., bookkeeper—Anim. Phy. (1st), with 1st prize; Music (1st), with 1st prize; Elect. and Magn. (2d); Geom. (3d); together with the Prince Consort's Prize of Twenty-five Guineas.

286—Hearson, Thomas A., 16, Devonport M.I., engineer (student)—Eng. Hist. (2d); Arith. (3d); Geom. (3d)

844—Hendrie, Robert, 21, Manchester M.I., clerk—Bkpg. (3d)

792—Henshall, John P., 24, Bollington Use. Know. Soc., cotton spinner—Arith. (3d)

655—Hensler, William, 20, City of London Coll.—Bkpg. (1st); Arith. (2d)

1228—Hepworth, William B., 17, Leeds M.I., medical student—Chem. (1st)

1087—Herbert, Thomas, 16, Scarboro' M.I., draper—Arith. (3d); Eng. Hist. (3d)

726—Heritage, Esther A., 25, Royal Polyt. Inst., governess—Eng. Hist. (2d)

1044—Hesford, John Martin, 17, Salford W.M. Coll., clerk—Bkpg. (2d)

1047—Hetherington, Mathias, 21, Salford W.M. Coll., clerk—Chem. (3d)

762—Hewison, Ralph Walker, 18, St. Michael's (Bromley) Evg. Classes—Arith. (3d)

1090—Hicks, Thomas John, 19, Scarboro' M.I., teacher—Arith. (3d); Eng. Hist. (3d); Latin, &c. (3d); French (2d).

656—Higgin, Charles C., 18, City of London Coll., clerk—French (2d)

1352—Higgin, William, 17, Slaidburn M.I., scholar—Arith. (3d); Eng. Hist. (3d); Eng. Lit. (3d); Geog. (3d)

657—Higgins, George, 30, City of London Coll., teacher—Music (2d).

1117—Higgs, James H., 28, Southampton Ath., coach painter—Bkpg. (2d)

410—Hill, David, 24, Glasgow Inst., sketchmaker—Free-hd. Dwg. (2d)

1148—Hill, Henry, 24, Messrs. Chance's Lib., designer—Bpkg. (2d)

30—Hill, William, 18, Acomb. Lit. Inst., clerk—Arith. (2d); Eng. Hist. (3d)

1118—Hill, William Burrough, 19, Southampton Ath., surveyor and architect's clerk—Freehand dwg. (3d)

536—Hills, Henry G., 22, Hertford Lit. and Sci. Inst., printer—Bkpg. (1st); Mens. (3d)

534—Hinchliffe, James, 18, Compstall Lib. and Reading Inst., pupil teacher—Arith. (3d); Eng. Hist. (3d); Geog. (3d)

1157—Hipwood, Thomas, 17, Stourbridge W.M. Inst., engine fitter—Arith. (3d)

658—Hobbs, Richard Benton, 26, City of London Coll., book-keeper—French (3d)

886—Hobson, Henry, 20, Middlesbro' M.I., draughtsman—Chemistry (1st)

879—Hobson, Richard Hughes, 23, Middlesbro' M.I., clerk—Chem. (2d)

164—Hodges, William, 16, Diocesan Trade School, Bristol, surgeon (proposed)—Chem. (3d)

508—Hodgson, Alfred, 20, Halifax W.M. Coll., overlooker—Bkpg. (2d)

659—Hodgson, Thomas, 16, City of London, clerk—Arith. (1st) with 2d prize

416—Holburn, Robert, 18, Glasgow, M.I., clerk—Bkpg. (1st)

202—Holden, Thomas, 21, Burnley Ch. of Eng. Inst. messenger—Chem. (3d)

197—Holgate, James, 19, Burnley M.I., clerk—Bkpg. (1st); Anim. Phy. (2d)
1161—Holloway, Frederick G., 19, Stourbridge M.I., bank clerk—Free-hd. Dwg. (3d)
1287—Holloway, George O'C., 18, Kidderminster M.I., merchant's clerk—Arith. (1st); Bkpg. (1st)
750—Hood, William, 21, London M.I., vellum binder —Alg. (2)
910—Hopps, Michael P., 17, Newcastle-on-Tyne M.I., clerk—Chem. (2d); Elect. and Magn. (3d)
1195—Hough, Joseph, 27, Wolverhampton W. Men's Coll., assistant in observatory—Light and Heat (2d); Chem. (2d); Astron. (3d)
487—Houstoun, Andrew M'Dowall, 20, Glasgow M.I., clerk—Arith. (1st)
842—Howarth, James, 19, Manchester M.I., clerk—Bkpg. (1st); Arith. (3d)
264—Howarth, William, 17, Dean Mills Inst., warehouseman—Arith. (2d)
509—Howorth, Edward, 24, Halifax W.M.C., woolsorter—Bkpg. (2d)
510—Howorth, SamuelC., 22, Halifax W.M.C., weaver, Bkpg. (2d)
1358—Hoyle, Giles, 24, Rawtenstall M.I., mule spinner —Arith. (3d)
234—Hudson, Richard Jones, 21, Chelmsford Lit. and M.I.—Arith. (3d)
661—Hudson, William, 29, City of London College, teacher—Alg. (1st)
662—Hughes, John, 21, City of London Coll., chemist's assistant—Dom. Econ. (1st), with 2d prize; Anim. Phy. (3d)
495—Hunsworth, John, 24, Halifax M.I., labourer—Arith. (3d)
454—Hunter, Charles D., 18, Glasgow M.I., draughtsman—Chem. (2d)
1303—Hunter, Henry L., 18, York Inst., teacher—Arith. (1st)
63—Hunter, Robert, 18, Banbridge Lit. and Mut. Imp. Soc., clerk—Bkpg (1st).
287—Hutchens, George W., 18, Devonport M.I., grocer's assistant—French (3d)
511—Ingham, James, 22, Halifax W.M.C., weaver—Bkpg. (2d)
462—Inglis, Francis, 17, Glasgow M.I., clerk—Bkpg. (1st)
481—Inglis, John, 17, Glasgow M.I., clerk—Eng. Lit. (3d)
663—Irish, William S., 19, City of London Coll., merchant's clerk—Bkpg. (1st)
1019—Ivemey, Thos., 24, Pembroke Dock M.I., caulker —Arith. (1st); Eng. Hist. (2d)
1261—Jack, John, 16, Woolwich Sci. Sch., metal turner —Geom. Dwg. (3d)
1053—Jackson, Thomas, 26, Salford W.M. Coll., clerk—Arith. (3d)
403—Jackson, William Vietch, 22, Glasgow Inst., working jeweller—Logic (3d)
75—Jakeman, Arthur W., 16, Banbury M.I., clerk—Eng. Lit. (1st), with 3d prize
5—Jamieson, Thomas, 17, Aberdeen M.I., clerk—French (2d)
482—Jardine, John, 24, Glasgow M.I., engineer—Arith. (2d)
541—Jarvis, Frank C., 16, Hitchin M.I., pupil teacher—Geog. (1st)
288—Jasper, Thomas, 24, Devonport M.I., shipwright—Nav. and Naut. Ast. (3d)
1272—Jenner, William, 22, Woolwich Sci. Sch., labourer —Chem. (3d)
664—Jennings, Henry, 26, City of London Coll., clerk —French (2d)
908—Jepson, Henry, 16, Newcastle-on-Tyne Ch. of Eng. Inst., clerk—Geog. (3d)
1050—Johnson, John, 17, Salford W.M. Coll., pupil teacher—Arith. (3d); Eng. Hist. (2d); Geog. (3d)
1248—Johnson, William, 20, Leeds Church Inst., railway clerk—Bkpg. (1st)
312—Johnston, James, 19, Edinburgh Phil. Inst., accountant's clerk—Arith. (3d)
15—Johnston, Robert, 20, Aberdeen M.I., writer—Bkpg. (2d)
845—Jones, Benjamin, 17, Manchester M.I.—Alg. (2d)
665—Jones, Henry Colville, 22, City of London Coll., iron merchant—Bkpg. (1st)
811—Jones, Thomas, 20, Manchester M.I., clerk—Arith. (2d); Bkpg. (1st)
1052—Jones, Thomas, 21, Salford W.M. Coll., cabinet maker—Geom. Dwg. (2d)
1016—Jones, William, 32, Pembroke Dock M.I., leading man of shipwrights—Arith. (1st); Mens. (3d)
1051—Jordan, Thomas, 24, Salford W.M. Coll., clerk—Bkpg. (2d)
1099—Judd, William, 18, Slough M.I., harness maker—Free-hd. Dwg. (2d)
326—Judges, John, jun., 16, Faversham Inst., pupil teacher—Arith. (3d)

1055—Kay, Reuben, 19, Salford W.M. Coll., warehouseman—Bkpg. (1st); French (3d)
1330—Kaye, Uriah, 18, Bradford M.I., woolsorter—Bkpg. (2d); Logic (3d); Alg. (3d)
39—Kearns, Samuel, 16, Soldier's Inst., Aldershot, clerk—Arith. (2d); Alg. (3d)
1130—Keen, George, 20, Corngreaves (Cradley Hth.) Inst., clerk in iron works—Chem. (3d)
666—Kennedy, John, 20, City of London Coll., clerk in H.M. Customs—Eng. Hist. (1st) with book prize; French (3d)
1054—Kenyon, Benjamin D., 20, Salford W.M. Coll. clerk—Chem. (2d)
982—Kershaw, Thomas, jun., 24, Oldham Sci. Sch., mechanic—Geom. Dwg. (1st)
973—Kettlewell, Samuel Elson, 25, Oldham Sci. Sch., joiner—Geom. Dwg. (3d)
24—Kilgour, George, 20, Aberdeen M.I., draper—Eng. Hist. (2d)
553—Kingston, Robert Creaser, jun., 18, Hull Young People's Chr. and Lit. Inst., under gardener—Arith. (1st)
314—Kirkwood, James, 18, Edinburgh Phil Inst., mercantile clerk—German (3d)
1220—Knapton, William, 36, Leeds M.I., mason—German (2d)

537—Lambert, James Newton, 19, Hertford Lit. and Sci. Inst., printer's assistant—Arith. (2d); Bkpg. (2d)
998—Lambie, William, 37, Paisley Artizan's Inst., harness weaver—Music (2d)
108—Lance, Walter H., 18, National Night Sch., Blandford, pupil teacher—Arith. (3d); Music (3d); Geog. (2d)
244—Lane, Elihu Burritt, 16, Christchurch W.M. Inst., pharmaceutical chemist—Arith. (3d)
372—Laughland, James, 19, Glasgow Ath., clerk—French (1st)
1059—Law, Edwin, 19, Salford W.M. Coll., clerk—Bkpg. (1st); Lat. and Rom. Hist. (1st), with 1st prize
1020—Lawrence, Alfred, 17, Pembroke Dock M.I., attorney's clerk—Arith. (1st)
385—Lawrie, David, 19, Glasgow Ath., insurance clerk —Geom. (3d)
1179—Lawson, James, 26, Willenhall Lit. Inst., grocer—Arith. (1st)
892—Lawton, William, 30, Mossley M.I., book-keeper—Bkpg. (3d)
514—Laycock, Henry, 26, Halifax W.M.C., clerk—Bkpg. (2d)
1299—Leaman, Andrew, 18, Worcester Catholic Inst., clerk—Arith. (2d); Eng. Hist. (2d); Geog. (2d); Eng. Lit. (3d)

667—Ledgar, James B., 18, City of London Coll., clerk —French (3d)
533—Lee, Abel, 21, Campstall Libr. and Read. Inst., weaver—Arith. (3d)
866—Lees, George, 18, Chancery-lane (Ardwick) Inst., clerk—Arith. (3d)
289—Lewis, Charles M., 16, Devonport M.I., engineer (student)—Arith. (2d); Geom. (3d)
1156—Lewis, William, jun., 23, Stourbridge M.I., accountant—French (3d)
1058—Lighthown, James H., 17, Salford W.M. Coll., invoice clerk—Arith. (3d); Chem. (2d)
1057—Littler, Peter, 25, Salford W.M. Coll., weighing machine clerk—Arith. (3d)
101—Loe, Grace Elizabeth, 19, Birm. and Midl. Inst., German (3d)
1217—Logan, Henry, 24, Wakefield M.I., ironfounder—Min. and Met. (2d); Pract. Mech. (2d)
1214—Logan, Walter, 17, Wakefield M.I., overlooker—Arith. (3d); Bkpg. (1st)
1120—Long, Charles, 30, Southampton Ath., porter—Music (2d)
668—Longdon, George Simmons, 20, City of London Coll., clerk—Bkpg. (1st)
838—Lord, John, jun., 16, Manchester M.I., librarian's assistant—Bkpg. (2d)
1310—Lord, John Thomas, 20, Haslingden M.I., warehouseman—Arith. (2d)
46—Lord, William, 19, Bacup M.I., clerk in mill—Bkpg. (1st); Anim. Phy. (2d)
168—Lorymer, Edward, 20, Bristol Ath., clerk—Bkpg. (2d)
975—Lowe, Alexander John, 31, Oldham Science School, whitesmith—Geom. Dwg. (3d)
958—Lowe, John, 17, Oldham Science School, book-keeper—Geom. Dwg. (3d)
*820—Lowndes, Richard, 20, Manchester M.I., solicitor's book-keeper—Bkpg. (2d)
492—Lumb, William E., 21, Halifax M.I., warehouseman—Arith. (3d)
125—Lunn, Joseph, 20, Bolton M.I., millwright—Pract. Mech. (3d); Princ. Mech. (3d)
851—Lunt, Thomas, 22, Manchester M.I., joiner—Bkpg. (2d)
455—McArthur, William Stewart, 18, Glasgow M.I., warehouseman—Bkpg. (2d)
332—McBride, Henry J., 21, Gilford Young Men's Mut. Imp. Soc.—Arith. (2d)
466—McCallum, Robert, 34, Glasgow M.I., collector of gas rates—Bkpg. (1st); Eng. Lit. (2d)
1008—McEwan, Robert, 27, Paisley Artizan's Inst., carpet weaver—Music (3d)
1123—McFadden, Arthur G., 16, Southampton Ath., clerk (Ordnance Survey)—French (2d)
997—McGibbon, Richard F., 26, Paisley Artizan's Inst., watchmaker—Music (1st)
1342—McGuire, Philip, 17, Bradford M.I., merchant's Clerk—Arith. (3d); French (3d); Geom. (2d)
544—Mc Intosh, Donald, 21, Hull Young People's Christian and Lit. Inst., merchant's clerk—Bkpg. (2d); German (3d)
552—McIntosh, Douglas, 16, Hull Young People's Christian and Lit. Inst., merchant's clerk—Arith. (3d)
388—McKechnie, William, 25, Glasgow Ath., colour-maker—Bkpg. (2d)
467—McKellar, Elizabeth, 24, Glasgow M.I., teacher—Arith. (3d); Animal Phy. (3d)
389—McKellar, Jane, 39, Glasgow Ath., teacher—Animal Phy. (2d)
425—McKenzie, Thomas, 18, Glasgow M.I., clerk—Bkpg. (1st)
395—McLachlan, 21, Glasgow Institute, clerk—Logic (2d)
459—M Minn, Thomas, 20, Glasgow M.I., clerk—Alg. (2d); Geom. (3d)
491—McMurtrie, John, 18, Glasgow M.I., clerk—Arith. (2d)
401—McNab, Robert, 21, Glasgow Institution, assistant teacher—Latin and Roman Hist. (3d)
442—McNeil, John, 19, Glasgow M.I., engineer—Arith. (1st)
81—McNeill, James, 18, People's Reading Rooms, Belfast, teacher—Arith. (1st); Mens. (3d)
407—McNicol, James, 19, Glasgow Inst.—Bkpg, (2d)
446—McNiven, David, 19, Glasgow M.I., warehouseman—Arith. (3d)
1007—MacKay, William, 28, Paisley Artizans' Inst., carpet weaver—Music (2d)
719—MacKechnie, Annie L., 29, Royal Polyt. Inst.—Italian (1st), with 2d prize
1013—Macarthur, Angus, 24, Paisley Artizans' Inst., weaver's foreman—Music (2d)
434—Macaulay, John, 20, Glasgow M.I., clerk—Bkpg. (2d)
397—Mackinlay, David, 23, Glasgow Inst., clerk—Lat. and Rom. Hist. (2d)
475—Macnaught, James R., 21, Glasgow M.I., clerk—Spanish (3d)
669—Maidstone, Richard, 22, City of London College, clerk—French (3d)
339—Mahony, James A., 23, Pop. Ev. Classes, Anders. Univ., Glasgow, clerk—Free-hd. Dwg. (3d)
1063—Makin, John Brownlow, 24, Salford W. M. College, warehouseman—Arith. (3d); Bkpg. (1st)
458—Malcolm, Alexander, jun., 20, Glasgow M.I., civil and mining engineer—Geom. (3d)
102—Mallin, Emala, 22, Birmingham and Midland Inst. —Eng. Hist. (3d)
917—Mann, George William, 25, Newcastle-on-Tyne M.I., engineer—Pract. Mech. (3d)
562—Mann, Philip Alfred, 22, Ipswich Working Men's Coll., clerk—Bkpg. (1st); Arith. (3d)
934—Marsden, Thomas, 18, Oldham Science and Art School, pattern maker—Geom. Dwg. (2d)
489—Marshall, Alexander S., 19, Glasgow M.I., clerk —Bkpg. (2d)
239—Marshall, Moses, 26, Christchurch W.M. Inst., plumber—Prac. Mech. (3d)
883—Marshall, William Stone, 17, Middlesborough M.I., attorney's clerk—Chem. (1st)
670—Maskell, Daniel, 32, City of London Coll., mercantile clerk—Bkpg. (1st)
119—Mason, George, 24, Bolton M.I., engineer—Chem. (3d)
834—Massey, William, 20, Manchester M.I., merchant's clerk—Eng. Hist. (2d); Free-hd. Dwg. (2d)
1121—Massy, Charles, 17, Southampton Ath., articled clerk—Bkpg. (2d)
473—Matheson, David, 22, Glasgow M.I., clerk—French (3d)
671—Mathew, John F., 26, City of London Coll., wine and spirit broker's clerk—Bkpg. (2d)
1015—Mathias, George Hitchings, 23, Pembroke Dock M.I., writer—Arith. (1st); English Hist. (3d); Geog. (3d)
782—Matthews, William, 17, Louth M.I., pupil teacher Arith. (3d)
1244—Maude, Joseph, 31, Leeds Church Inst., railway clerk—Bkpg. (2d)
783—Mawer, Walter, 17, Louth M.I., printer's apprentice—Logic, &c. (2d)
315—May, Thomas, 22, Edinburgh Phil. Inst., clerk—French (3d)
484—May, William Walker, 21, Glasgow M.I., engineer—Arith. (3d)
673—Meadows, William, 17, City of London Coll., picture-frame maker—Bkpg. (1st); Alg. (2d); Mens. (2d); Trig. (3d)
580—Medd, William, 16, Leeds Y.M. Christ. Assoc., clerk—Arith. (3d)

674—Medhurst, John T., 18, City of London Coll., clerk—French (3d)
140—Merry, Edwin A., 20, Bristol Trade School, architects' clerk—Geom. Dwg. (1st) with 1st prize
498—Midgley, John, 23, Halifax M.I., clerk—Bkpg. (1st)
494—Midgley, Samuel, 20, Halifax M.I., currier—Bkpg. (2d)
479—Millar, William J., 26, Pop. Evg. Cl., Anders. Univ., Glasgow, collector—Princ. Mech. (3d)
472—Miller, David, 17, Glasgow M.I., clerk—Bkpg. (1st)
436—Miller, Robert Napier, 19, Glasgow M.I., storekeeper's assistant—Bkpg. (1st)
432—Miller, William, 18, Glasgow M.I., clerk—Bkpg. (2d)
1062—Mills, Henry, 21, Salford W.M. Coll., clerk—Bkpg. (1st)
468—Milne, James Mitchell, 18, Glasgow M.I., chemist—Bkpg. (2d)
316—Milne, John, 25, Edinburgh Phil. Inst., teacher—Italian (1st); German (2d); French (2d)
376—Milne, John B., 23, Glasgow Ath., clerk—French (1st)
990—Milne Robert, 26, Paisley Artizans' Inst., shawl weaver—Arith. (3d)
255—Minns, John W., 17, Crewe M.I., pupil teacher—Arith. (3d); Geog. (3d)
718—Minter, John, 23, Royal Polyt. Inst., clerk—Arith. (3d)
26—Mitchell, George, 24, Aberdeen M.I., jeweller—Arith. (3d)
888—Mitchell, George, 23, Mossley M. I., clerk—Arith. (3d); Bkpg. (2d)
993—Mitchell, Robert, 18, Paisley Artizans' Inst., weaver—Arith. (2d)
290—Mogg, Thomas Holt, 24, Devonport M.I., pawnbroker's assistant—Eng. Hist. (2d); Arith. (3d); Geog. (3d)
370—Moir, Charles S., 16, Glasgow Ath., clerk—French (2d)
893—Moorhouse, Thomas, 19, Mossley M.I., clerk—Bkpg. (1st)
291—Morcom, Alfred, 16, Devonport M.I., engineer (student)—Arith. (2d); Eng. Hist. (2d)
676—Morgan, Hugh, 18, City of London Coll., banker's clerk—Arith. (1st); Eng. Hist. (1st), with 2d prize
862—Morris, Thomas, 21, Christ Church (Hulme) Inst., clerk—Arith. (3d)
471—Morrison, Robert, 19, Glasgow M.I., clerk—Bkpg. (2d)
402—Morrison, Thomas, 16, Glasgow Inst., draper—Arith. (2d)
18—Mortimer, John M., 23, Aberdeen M.I., mason—Princ. Mech. (3d)
219—Mortimer, William, 25, Bury Ath., weaver—Arith. (3d)
120—Moscrop, Robert, 43, Bolton M.I., mechanic—Chem. (1st)
1282—Mott, James, 34, Greenwich Sci. Sch., engineer—Geom. Dwg. (3d)
577—Mountain, Joseph, 21, Leeds Y.M.C. Assoc.—clerk—Bkpg. (1st)
588—Muirhead, Andrew, 48, Leicester Ch. of Eng. Inst., staff sergeant—Lat. and Rom. Hist. (1st) with 2d prize
474—Muirhead, John, 36, Glasgow M.I., out-door officer H.M. Customs—Eng. Lit. (2d)
153—Munro, John, 16, Bristol Trade School, engineer—Geom. Dwg. (2d)
226—Murray, James, 25, Carlisle M.I., clerk—Bkpg. (1st)
384—Murray, James, 22, Glasgow Ath., mercantile clerk—Arith. (1st)
1000—Murray, James, 24, Paisley Artizan's Inst., foreman—Music (2d)
191—Nelson, John, 17, Burnley M.I., warehouseman—Arith. (2d)
171—Newton, Henry C., 19, Bristol Ath., clerk—Bkpg. (2d); French (3d)
839—Newton, James, 18, Manchester M.I., invoice clerk—Bkpg. (1st)
292—Nichols, Charles Grose, 22, Devonport M.I., shipwright—Arith. (2d); French (3d)
1028—Nichols, W. D., 17, Peterboro' M.I., clerk—Geog. (1st)
776—Nicholls, Frederick, 16, St. Stephen's (Westmin.) Evg. Sch., clerk—Eng. Hist. (3d); French (3d)
989—Niven, David Coats, 23, Paisley Artizans' Inst., collector of gas rates—Logic, &c. (2d)
1213—Noble, John, 22, Wakefield M.I., carver and gilder Arith. (2d); Bkpg. (2d)
496—Noble, Joseph, 20, Halifax M.I., warehouseman—Arith. (1st)
740—Nops, Francis, 19, Royal Poly. Inst., inland revenue officer—Arith. (1st)
294—Norsworthy, John W. H., 17, Devonport M.I., pupil teacher—Geog. (1st); Arith. (2d)
556—North, Wesley, 17, Hunslet M.I., engineer—Arith. (2d); Prac. Mech. (3d)
169—Norton. John A., 18, Bristol Min. Sch., medical student—Arith. (1st); Alg. (2d); Geom. (3d)
1143—Norton, Paul, 17, Messrs. Chance's Evg. Sch., Birmingham, pupil teacher—Geog. (3d)

433—Oatt, James William, 16, Glasgow M.I., clerk—Bkpg. (2d)
440—Ogilvie, Thomas, 18, Glasgow M.I., comm. clerk—Arith. (2d)
1158—Oldfield, Harry G., 18, Stourbridge Ch. of England Y. Men's Assoc., draper—French (3d)
186—Oldham, Joshua, 25, Burnley M.I., power-loom weaver—Arith. (3d)
1203—Ordish, James, 28, Wolverhampton W. Men's Coll., sergeant of police—Bkpg. (2d)
573—Orriss, James S., 16, Ipswich W.M.C., clerk—Bkpg. (2d); Geog, (3d)
515—Osborne, William, 16, Halifax W.M.C., clerk (junior)—Arith. (1st); Alg. (3d)
1168—Overton, Frederick Job, 22, Walsall Ch. Inst., saddler's ironmonger—Bkpg. (1st)
71—Owen, Arthur, 17, Banbury M.I., pupil teacher—Arith. (2d); Eng. Hist. (2d); Eng. Lit. (1st)
821—Owen, Griffith Hughes, 22, Manchester M.I., bookkeeper and cashier—Bkpg. (1st)
228—Owen, John A., 16, Chatham, &c., M.I.—Arith. (3d); Alg. (3d)
678—Packenham, Jesse J., 32, City of London Coll., viewer, Iron Inspection Department, Tower—Dom. Econ. (2d); Geom. (2d)
364—Pagan, John, 21, Glasgow Ath., clerk—Bkpg. (1st); French (2d)
582—Page, John W., 21, Leeds Y.M.C. Assoc., clerk—Arith. (3d)
729—Page, Robert W., 23, Royal Polyt. Inst., brass finisher, &c.—Chem. (2d)
109—Painter, Edwin T., 20, National Night School, Blandford, clerk—Arith. (2d); Geog. (2d)
680—Palmer, Edward, 17, City of London Coll., clerk—French (3d)
899—Park, James, 16, Mossley M.I., piecer—Bkpg. (1st)
480—Parker, John Dunlop, 21, Glasgow M.I., civil engineer—Mens. (3d)
142—Parker, Samuel Isaac, 19, Bristol Trade School, engineer—Geom. Dwg. (1st)
148—Parker, William H., 21, Bristol, engineer—Geom. Dwg. (1st)
1177—Parkes, Josiah, 17, Willenhall Lit. Inst., clerk—Bkpg. (1st)
1184—Parkes, Samuel, 18, Willenhall Lit. Inst., clerk—Arith. (1st)

273—Parkinson, Alfred, 23, St. Peter's (Derby), Evg. School, book-keeper—Arith. (1st); Bkpg. (1st); Alg. (2d)
1137—Parry, Edward, 16, Woodside Iron-works Imp. Soc., fitter—Arith. (3d)
1256—Parry, Parton T. W., 27, Woolwich Sci. Sch., saddler—Geom. Dwg. (2d)
681—Parsons, William G., 24, City of London Coll., clerk—French (2d)
569—Paternoster, Robert, 18, Ipswich W.M.C., pupil teacher—Eng. Hist. (1st)
916—Patterson, William, 18, Newcastle-on-Tyne, M.I., clerk—Arith. (2d)
744—Payne, Martin H., 23, London M.I., chemist and druggist—Elect. and Magn. (2d); Chem. (2d)
110—Payne, James, jun., 27, Blandford Working Men's Club, attorney's clerk—Eng.Hist.(2d); Geog.(2d)
1332—Peacock, Charles, 20, Bradford M.I., warehouseman—Bkpg. (2d)
728—Pearson, Henry, 16, Royal Poly. Inst., clerk—Arith. (2d)
310—Peden, Alexander, 23, Edinburgh Phil. Inst., clerk—Bkpg. (2d)
428—Peebles, Robert, 23, Glasgow M.I., clerk—Arith. (3d)
1324—Pemberton, John J., 17, Blackburn M.I., collector—Arith. (3d)
540—Penn, Harry, 22, Hitchin M.I., draper—Dom. Econ. (3d)
116—Pennington, Robert T., 20, Holy Trinity (Bolton) W.M. Assoc., warehouseman—Chem. (3d)
682—Percival, Lionel J., 18, City of London Coll., clerk—Bkpg. (1st)
374—Perston, John, jun., 18, Glasgow Ath., clerk—Bkpg. (1st)
683—Pertis, John N., 20, City of London Coll., clerk—Bkpg. (1st)
252—Peters, Samuel, 17, Crewe M.I., apprentice fitter—Arith. (3d); Bkpg. (3d)
1144—Pewtress, Ebenezer, 20, Messrs. Chance's Lib., Birmingham, clerk—Bkpg. (1st)
685—Phillips, William R., 16, City of London Coll., clerk—Arith. (2d)
10—Phillips, William Thompson, 25, Aberdeen M.I., clerk—Bkpg. (3d)
296—Pike, Robert Hicks, 20, Devonport M.I., shipwright's apprentice—Arith. (1st); Mens. (3d)
1211—Pilkington, Herbert, 23, Wakefield M.I., millwright—Bkpg. (1st); Arith. (3d); Pract. Mech. (3d)
1242—Pinder, John W., 16, Leeds M.I., medical pupil—Arith. (3d); Eng. Hist. (3d); Alg. (3d)
155—Plant, Edmund Carter, 22, Bristol, science teacher—Geom. Dwg. (1st)
145—Plant, Walter A., 16, Bristol Trade School, farmer—Geom. Dwg. (2d)
343—Pollack, Arthur, 18, Pop. Evg. Classes, Anders. Univ., Glasgow, Turkey-red dyer—Chem. (1st)
600—Pollack, William, 23, Liverpool College, joiner—Arith. (3d); Mens. (3d)
686—Pollard, Henry Thomas, 17, City of London Coll., clerk—Eng. Lit. (1st), with 1st prize.
1223—Pollard, Joseph, 26, Wilsden M.I., warehouseman—Arith. (3d); Bkpg. (3d)
1066—Poole, James H., 16, Salford W.M. Coll., clerk—Arith. (1st); Bkpg. (1st)
13—Pope, Samuel, jun., 27, Aberdeen M.I., writer—Free-hd Dwg. (3d)
79—Porter, John, 23, People's Reading Rooms, Belfast, teacher—Arith (2d); Eng. Hist. (2d); Eng. Lit. (2d); Geog. (1st)
909—Potts, John J., 20, Newcastle-on-Tyne Ch. of Eng. Inst., mercantile clerk—Free-hd Dwg. (3d)
1124—Powell, Charles, 18, Southampton Ath., clerk—Arith. (1st); Music (2d)
594—Power, John, 20, Litchfield Working Men's Asso., grocer's assistant—Arith. (3d); Music (2d)
189—Preston, John, 21, Burnley M.I., power-loom weaver—Arith. (3d)
687—Price, William, 29, City of London Coll., clerk—Spanish (1st) with 2d prize; French (3d)
449—Primrose, Adam, 16, Glasgow M.I., civil engineer—French (3d); Geom. (3d)
688—Prince, Thomas, 24, City of London College, stationer—German (1st)
848—Prior, John Thomas, 20, Manchester M.I., clerk—Bkpg. (1st)
350—Provand, Dixon, 17, Pop. Evg. Classes, Anderson. Univ., Glasgow, chemistry student—Chem. (2d); Alg. (3d)
567—Pyett, Charles H., 18, Ipswich W.M.C., corn merchant's assistant—Bkpg. (2d)
769—Pywell, John E., 16, St. Stephen's (Westm.) Evg. School—Arith (3d)
903—Radcliffe, William, 21, Mossley M.I., cotton piecer—Bkpg. (2d)
1298—Randall, John, 19, Worcester Catholic Inst., commercial clerk—Eng. Hist. (3d); Geog. (3d)
563—Read, Arthur G., 21, Ipswich W.M.C., clerk—Arith. (3d); Bkpg. (2d)
181—Reed, William, 17, Nelson M.I., weaver—Chem. (3d)
1146—Reeves, Frederick, 24, Messrs. Chance's Library, glasscutter—Bkpg. (2d)
822—Reid, David, 24, Manchester M.I., ironmonger—Geom. Dwg. (3d)
860—Reid, Robert, 21, Manchester M.I., engineer—Geom. Dwg. (1st)
549—Reinold, Edward Konrad, 20, Hull Young People's Ch. and Lit. Inst., engineer's apprentice—German (1st) with 2d Prize; Geom. (3d)
368—Relton, Richard, 17, Glasgow Ath., clerk—Bkpg. (1st)
269—Renfrew, William, 24, St. John's (Deptford) Evg. Classes, mechanic—Geom. Dwg. (2d)
421—Rennie, John, 20, Glasgow M.I., clerk—Eng. Hist. (3d)
978—Reyner, Ernest, 33, Oldham Science Sch., mechanic—Geom. Dwg. (2d)
1371—Rich, Sidney W., 17, Lambeth Local Board, professional chemist—Chem. (2d)
113—Rigby, William, jun., 18, Holy Trinity (Bolton) W.M.I., mechanic—Arith. (3d); Eng. His. (3d)
690—Rigg, Thomas, 19, City of London Coll., clerk—Arith. (2d); Geog. (2d)
988—Risk, Robert, jun., 26, Paisley Artizan's Inst., coal agent—Bkpg. (2d)
747—Rita, Edward, 21, London M.I., compositor—Eng. Lit. (2d)
1224—Roberts, Charles, 17, Leeds M.I., clerk—Arith. (3d)
1068—Roberts, Edward, 25, Salford W.M. Coll., clerk—Bkpg. (1st)
836—Roberts, Frederick, 18, Manchester M.I., book-keeper—Bkpg. (1st)
732—Roberts, Henry Knowles, 17, Royal Polyt. Inst., chemical assistant—Chem. (2d)
516—Robertshaw, Thomas, 20, Halifax W.M.C., carpet weaver—Bkpg. (2d)
971—Robinson, Charles H., 26, Oldham Science School, mechanic—Geom. Dwg. (3d)
261—Robinson, John, 17, Crewe M.I., fitter—Arith. (2d)
78—Robinson, Ninian John, 17, People's Reading Rooms, Belfast, apprentice in linen warehouse—Arith. (3d)
1070—Robinson, Richard, 28, Salford W.M. Coll., dyer—Chem. (2d)
248—Robinson, Thomas, jun., 17, Clitheroe M.I., power loom weaver—Arith. (3d); Geog. (3d)
250—Robinson, Thomas, sen., 23, Clitheroe M.I., power loom weaver—Arith. (3d)

1223—Robinson Walter J., 27, Leeds M.I., mechanic—Geom. Dwg. (2d); Alg. (2d); Mens. (3d)
721—Roden, Thomas, 23, Royal Polyt. Inst., clerk—Bkpg. (1st)
413—Rodger, Eliza, 20, Glasgow Inst., Free-hnd. Dwg. (2d)
25—Rose, John, jun., 19, Aberdeen M.I., teacher—Arith. (2d)
351—Ross, George, 30, Pop. Evg. Classes, Anders. Univ. Glasgow, tailor—Anim. Phy. (3d)
1309—Rostron, Edward C., 17, Haslingden M.I., weaver—Arith. (3d)
299—Rowe, Charles R., 18, Devonport M.I., clerk—Arith. (2d)
230—Rowe, George F. A., 24, Chatham, &c., M.I., clerk—Alg. (3d); Geog. (3d)
1017—Rowe, James G. W., 16, Pembroke Dock M.I., clerk—Arith. (2d); Bkpg. (3d)
919—Rowell, Robert H., 18, Newcastle-on-Tyne M.I., chemist and druggist (apprentice)—Chem. (2d)
922—Rushworth, John, 26, Oldham Analytic Inst., iron turner—Geom. Dwg. (2d)
357—Russell, Archibald, 19, Pop. Evg. Classes, Anders. Univ., Glasgow, teacher—Music (3d)
691—Ryan, Andrew J., 19, City of London Coll., clerk—Arith. (1st); Geog. (3d)
801—Rydings, Robert, 32, Manchester M.I., warehouseman—Bkpg. (2d)
187—Sagar, Elijah, 20, Burnley M.I., assistant book-keeper—Arith. (2d)
175—Sagar, Obadiah, 17, Padiham Trades' Hall, draughtsman—Arith. (1st); Anim. Phy. (2d)
692—Salter, Thomas, 19, City of London Coll., clerk—Bkpg. (1st)
816—Sanderson, John Glasgow, 18, Manchester M.I., engineer—Geom. Dwg. (2d)
853—Sanderson, William, 17, Manchester M.I., millwright—Arith. (3d)
1096—Sargeant, John, 20, Slough M.I., carpenter—Geom. Dwg. (1st) with 2d prize
693—Sarll, Andrew, 27, City of London Coll., school assistant—Arith. (2d)
694—Saunders, Lindon O'S., 19, City of London Coll., architect—Free-hd. Dwg. (3d)
941—Scholes, Elijah, 19, Oldham Lyceum, clerk—Arith. (3d)
864—Scotson, Joseph, 22, Christ Church (Hulme) Inst., coal dealer and porter—Arith. (2d)
386—Scott, James, 18, Glasgow Ath., clerk—Bkpg. (1st)
1071—Scott, William, 23, Salford W.M. Coll., book-keeper—Arith. (3d)
586—Seale, Henry, 19, Leicester Ch. of Eng. Inst., bookbinder—Music (1st)
897—Seel, Thomas Dransfield, 16, Mossley M.I., warehouseman—Bkpg. (2d)
67—Seeton, Thomas, 27, Banbridge Lit. and Mut. Imp. Inst., writing clerk—Arith. (3d); French (3d)
1003—Semple, Robert, 24, Paisley Artisans' Inst., shawl pattern designer—Music (1st)
925—Senior, Thomas, 35, Oldham Analytic and Lit. Inst., mechanic—Geom. Dwg. (1st)
300—Sennett, Richard, 17, Devonport M.I., engineer (student)—Alg. (2d); Princ. Mech. (2d)
1149—Sergeant, Thomas J., 18, Messrs. Chance's Lib., clerk—Bkpg. (2d)
134—Sewell, James C., 26, Holy Trinity (Bolton) W.M. Inst., clerk—Anim. Phy. (3d)
1197—Shann, George V., 18, Wolverhampton W.M. Coll., carrier's clerk—Bkpg. (1st); French (2d)
1346—Sharp, Tom, 19, Bradford M.I., weaving overlooker—Geog. (2d)
1074—Sharrocks, Daniel, 24, Salford, W.M.C., packer—Arith. (3d)
517—Shaw, Thomas, 21, Halifax W.M.C.—Bkpg. (2d)
4—Shepherd, John, 23, Aberdeen M.I., compositor—French (2d)
1073—Shorrocks, James H., 17, Salford W.M. Coll., clerk—Bkpg. (1st); Arith. (2d); French (3d)
301—Showan, Thomas, 19, Devonport M.I., pupil teacher—Geog. (1st); Eng. Hist. (2d)
329—Sibbett, James, 20, Gilford Y. Men's Mut. Imp. Soc., clerk—Bkpg. (2d)
960—Sidey, John H., 26, Oldham Science School, millwright—Geom. Dwg. (1st)
302—Sidman William, 17, Devonport M.I., clerk—Arith. (3d)
695—Simmons, John D., 29, City of London Coll., oilman—French (3d)
755—Simon, James Sutherland, 28, London M.I., clerk—Light and Heat (1st), with 2nd Prize; Eng. Hist. (1st)
430—Sinclair, Margaret L., 17, Glasgow M.I., assistant teacher—Anim. Phy. (3d)
1018—Sinnette, George M., 23, Pembroke Dock M.I., writer—Bkpg. (2d)
1006—Slater, James, 25, Paisley Artizans' Inst., smith—Music (2d)
203—Slater, William, 19, Burnley Ch. of Eng. Inst., engineer (apprentice)—Arith. (3d)
378—Smellie, John Brash, 21, Glasgow Ath., clerk—Bkpg. (1st)
396—Smillie, George, 19, Glasgow Inst., brass finisher—Logic (2d)
878—Smith, David, 24, Middlesbro' M.I., out-door officer (customs)—Bkpg. (1st)
317—Smith, Elizabeth Verralls, 19, Edinburgh Phil. Inst.—Music (2d)
828—Smith, Henry C., 17, Manchester M.I., warehouseman—German (2d); Alg. (2d); Free-hand Dwg. (2d)
1335—Smith, James, 19, Bradford M.I., clerk—Arith. (2d); Bkpg. (2d); Pol. Econ. (2d); Geog. (2d)
50—Smith, James Howker, 22, Bacup M.I., weaver, Arith. (3d)
697—Smith, James Rigby, 24, City of Lon. Coll., clerk—Alg. (1st), with 2nd prize; Logic, &c. (1st)
211—Smith, John, 25, Burnley Ch. of Eng. Inst., weaver—Chem. (3d)
346—Smith, John, 23, Pop. Evg. Classes, Anders. Univ., Glasgow, clerk—Bkpg. (2d)
519—Smith, John, 18, Halifax Working Men's College, drysalter—Chem. (2d)
912—Smith, John Embleton, 22, Newcastle-on-Tyne M.I., clerk—Arith. (3d); Eng. Lit. (2d)
1187—Smith, Joseph, 21, St. Peter's Night School, Wolverhampton, certificated teacher—Arith (2d)
748—Smith, Martha, 19, London M.I.—Geog. (2d)
1341—Smith, Samuel, 17, Bradford M.I., woolstapler's clerk—Arith (3d); Geog. (3d)
29—Smith, William, 23, Accrington M.I., warehouseman—Arith. (3d)
34—Smither, John, 16, Farnham Young Men's Assoc., carpenter and cabinet maker—Arith. (1st); Bkpg. (2d); Mens. (3d)
463—Smyth, Hugh F., 20, Glasgow M.I., clerk—Bkpg. (1st)
570—Snell, Harry, 16, Ipswich W.M.C., pupil to an architect—Bkpg. (2d)
1100—Snowball, William, 19, Slough M.I., builder—Geom. Dwg. (3d)
557—Solomon, John, 17, Ipswich W.M. Coll., clerk—French (3d)
267—Spacey, Alfred, 24, Deptford Local Board, shipwright—Arith. (2d)
1125—Sparks, John, 16, Southampton Ath.—Arith. (1st); Bkpg. (2d); Geom. (3d)
520—Speak, William, 16, Halifax W.M.C., timekeeper, Bkpg. (1st)
485—Speirs, John, 20, Glasgow M.I., clerk—Spanish (2d)

521—Spencer, John, 23, Halifax W.M.C., woolsorter—Bkpg. (2d)
1173—Spencer, John, 19, West Bromwich Y. Men's Christian Inst., clerk—Bkpg. (2d); Pract. Mech. (3d); Free-hand Dwg. (3d)
208—Spencer, Robert, 21, Burnley Ch. of Eng. Inst., gardener—Chem. (3d)
699—Spiers, William, 18, City of London Coll., clerk—Eng. Hist. (1st), with 1st prize
1347—Spinks, Frederick, 17, Bradford M.I., grocer's assistant—Geog. (1st)
700—Sproxton, John, 26, City of London Coll., clerk—Bkpg. (2d); Arith. (3d)
1188—Stanier, William H., 16, Wolverhampton W.M.C., railway clerk—Geom. (3d)
1348—Stansfield, James B., 18, Bradford M.I., warehouseman—Arith. (3d)
950—Stansfield, William H., 19, Oldham Science School, turner—Geom. Dwg. (3d)
1104—Stanton, George, 24, Maidenhead M.I., gardener—Botany (1st) with 1st prize, together with the Horticultural Society's prize of £5.
469—Steel, James Boyd, 33, Glasgow M.I., commercial traveller—Bkpg. (2d)
377—Steel, William, 17, Carlton-pl. Evg. School, Glasgow, clerk—Chem. (3d)
404—Stewart, Elizabeth McLaren, 17, Glasgow Inst.—Bkpg. (2d)
62—Stewart, Robert, 19, Bacup M.I., assistant master—Alg. (2d)
701—Stiles, Walter, 22, City of London Coll., clerk—Bkpg. (1st)
1247—Stoner, John, 21, Leeds Church Inst., railway clerk—Bkpg. (2d)
994—Strachan, James, 23, Paisley Artizan's Inst., weaver's foreman—Arith. (3d)
590—Street, John Westrope, 16, Lichfield W.M. Inst., chemist and druggist—Arith. (3d)
601—Stuart, Alexander Bruce, 26, Liverpool College, clerk—Bkpg. (2d)
752—Styles, Alice Chillingworth, 21, London M.I.—Geog. (1st)
722—Sullivan, Ellen, 23, Roy. Poly. Inst.—French (3d)
196—Sumner, Henry, 22, Burnley M.I., weaver—Arith. (3d)
55—Sutcliffe, George William, 16, Bacup M.I., weaver—Arith. (2d); Chem. (3d); Mens. (3d)
522—Sutcliffe, Samuel, 21, Halifax W.M.C., joiner and builder—Eng. Lit. (2d)
829—Sutcliffe, William Thompson, 18, Manchester M.I., clerk—French (2d)
1351—Sutherland, John, 37, St. Michael's Evg. School, sergeant of police—Geog. (2d)
765—Swain, Henry W., 18, St. Michael's (Bromley) Evg. Classes, compositor—Arith. (3d)
1264—Swinger, William, 25, Woolwich Sci. Sch., draughtsman—Geom. Dwg. (1st)
754—Symes, Maurice, 20, London M.I., government clerk—Bkpg. (1st); French (3d)

1126—Tabb, Richard Prestridge, 19, Southampton Ath., merchant's clerk—Music (2d)
158—Tabrett, Henry, 16, Bristol Trade Sch., engineer—Geom. Dwg. (3d)
9—Tait, James, 22, Aberdeen M.I., clerk—French (1st), with 2d prize
1343—Tankard, Samuel, 18, Bradford M.I., woolsorter—Geog. (2d)
1077—Tate, Harry Booth, 17, Salford W.M. Coll., clerk—Arith. (1st)
599—Tate, Walter, 19, Liverpool Coll., clerk—Arith. (3d); Eng. Hist. (3d); Geog. (3d)
324—Taylor, Baron George H., 18, Faversham Inst., clerk—Eng. Hist. (3d)
76—Taylor, Charles, 16, Banbury M.I., clerk—Anim. Phy. (1st), with 2d prize; Eng. Hist. (3d)
924—Taylor, James, 16, Oldham Analytic and Literary Inst., mechanic—Geom. Dwg. (1st)
1127—Taylor, Jehu, jun., 20, Southampton Ath., clerk—Music (2d)
303—Taylor, John A., 16, Devonport M.I., grocer—Arith. (3d); Bkpg. (2d)
981—Taylor, Lees, 22, Oldham Science School, joiner—Geom. Dwg. (2d)
464—Taylor, Robert, 25, Glasgow M.I., foreman in saw mill—Arith. (3d)
881—Taylor, Thomas, 16, Middlesbro' M.I., accountant Bkpg. (2d)
817—Taylor, William, 17, Manchester M.I., assistant in an office—Bkpg. (2d)
986—Taylor, William, 28, Oldham Science School, mechanic—Geom. Dwg. (1st)
703—Teat, William M., 20, City of London Coll., book-keeper—Alg. (2d)
358—Telfer, Watson, 22, Pop. Evg. Classes, Anders. Univ. Glasgow, inland revenue officer—Arith. (2d)
884—Telford Robert, 16, Middlesbro' M.I., accountant—Bkpg. (2d); Arith. (3d)
921—Tetlow, James, 17, Werneth M.I., mechanic—Arith. (3d); Bkpg. (3d)
304—Thearle, Samuel, 18, Davenport M.I., shipwright—Dom. Econ. (1st)
437—Thislie, Robert, 16, Glasgow M.I., clerk—Arith. (3d)
947—Thomas, George, 26, Oldham Science School, mechanic—Geom. Dwg. (3d)
889—Thomas, Halliwell, 20, Mossley M.I., clerk—Bkpg. (1st)
803—Thomas, John, 20, Manchester, M.I., warehouseman—Bkpg. (1st)
*977—Thomas, John, 26, Oldham Science School, house joiner—Geom. Dwg. (2d)
1021—Thomas, Robert, 17, Pembroke Dock M.I., writer Arith. (3d)
974—Thompson, Alexander Baird, 26, Oldham Science School, bellhanger—Geom. Dwg. (1st)
185—Thompson, James, 23, Burnley M.I., clerk—Arith. (1st)
1078—Thompson, John, 19, Salford W.M. Coll., warehouse clerk—Arith. (3d)
*393—Thomson, George W., 19, Carlton-place School Evg. Classes, Glasgow, clerk—Min. and Met. (2d)
453—Thomson, James A., 18, Glasgow M.I., clerk—French (3d)
918—Thorburn, John, 19, Newcastle-on-Tyne M.I., clerk—Chem. (2d); Elect. and Magn. (3d)
319—Thornicraft, Thomas C., 19, Faversham Inst., articled to a surgeon—Bkpg. (1st); Arith. (2d); Anim. Phy. (3d)
323—Thornicraft, William, 16, Faversham Inst., clerk—Bkpg. (2d)
220—Thornton, William, 24, Calverley M.I., cloth weaver—Arith. (1st); Bkpg. (2d); Free-hd. Dwg. (3d).
1103—Thorpe, Charles Stuart, 18, Slough M.I., carpenter and joiner—Geom. Dwg. (1st)
1368—Tidmarsh, John, 17, Lambeth Local Board, pupil teacher—Arith. (3d)
1221—Tiffany, John Barnes, 21, Leeds M.I., tobacco manufacturer—Algebra (1st); Mens. (3d)
1079—Tinling, Thomas, 19, Salford W.M. Coll., warehouseman—Bkpg. (2d)
222—Todd, Garnett, 19, Carlisle M.I., clog-maker—Bkpg. (1st); Arith. (3d)
841—Todd, Joseph Hulme, 20, Manchester M.I., clerk—Arith. (3d)
1219—Todd, William, 18, Leeds M.I., woollen manufacturer, Eng. Lit. (1st), with prize of books; Logic (3d)
859—Tomkins, Edward, 19, Manchester M.I., draughtsman—Geom. Dwg. (3d)

256—Tomlinson, John J., 20, Crewe M.I., engineer—Eng. Hist. (3d)
1359—Tomlinson, Matthew, 28, Rawtenstall M.I., spinner—Arith. (1st)
263—Tomlinson, Thomas D., 18, Crewe M.I., engineer Arith. (2d)
340—Tosh, Edmund George, 18, Pop. Evg. Classes, Anders. Univ., Glasgow, chemist—Chem. (1st), with 1st prize
23—Tough, James, 19, Aberdeen M.I., pupil teacher—Arith. (2d); Geog. (2d)
111—Townson, Wm., 20, Bolton M.I., joiner—Chem. (2d)
305—Treleaven, Joseph T., 20, Devonport M.I., shipwright apprentice—Arith. (1st); Mens. (2d); French (3d)
565—Trent, Henry C., 17, Ipswich W.M.C., currier's apprentice—Arith. (3d); Bkpg. (2d)
41—Trout, Thomas, 19, Aldershot Mission Hall and Soldiers' Inst., clerk—Arith. (3d); Bkpg. (2d)
1370—Turner, Albert, 24, Lambeth Evg. Classes, junior clerk—Arith. (3d); Eng. Hist. (3d); Geog. (3d)
162—Turner, Thomas W., 17, Bristol Trade School, still at school—Chem. (3d)
1170—Turner, William, 18, Messrs. Bagnall's School, Gold's-hill, pupil teacher—Eng. Hist. (3d); Geog. (3d)
260—Turnbull, Ralph, 39, Crewe M.I., schoolmaster—Arith. (3d)

379—Waddell, Alexander, 23, Glasgow Ath., book-keeper—French (3d)
383—Wade, James, 28, Glasgow Ath., cashier—Eng. Hist. (1st) with book prize; Eng. Lit (1st) with 2d prize; Geom. (1st) with 1st prize.
724—Wagner, Henry A., 25, Royal Polyt. Inst., clerk in Phœnix Fire Office—Alg. (3d)
1222—Wainwright, Henry, 21, Leeds M.I., merchant's clerk—Alg. (3d)
104—Waldron, Joseph T., 19, Birm. and Midl. Inst., mechanical draughtsman—Pract. Mech. (3d)
1328—Walker, John, 19, Blackburn M.I., warehouseman Arith. (3d); Pol. Econ. (2d)
311—Walker, Robt., 22, Edinburgh Phil. Inst., insurance clerk—German (2d)
802—Walker, William, 24, Manchester M.I., clerk—Eng. Hist. (2d)
20—Walker, William P. Smith, 23, Aberdeen M.I., clerk—Arith. (3d)
927—Wallwork, James, 21, Henshaw-street M. Imp. Soc. (Oldham), weaver—Arith. (2d)
132—Wallwork, William, 17, Bolton M.I., brass finisher—Free-hand Dwg. (3d)
51—Walsh, James, 19, Bacup M.I., throstle overlooker—Arith. (2d); Anim. Phy. (3d)
523—Walsh, James, 20, Halifax W.M.C., warehouseman—Bkpg. (1st)
913—Walton, John, 18, Newcastle-on-Tyne M.I., chemist and druggist—Chem. (1st); Elec. & Mag. (3d)
204—Walton, Robert, 21, Burnley Ch. of Eng. Inst., weaver—Arith. (2d); Chem. (2d)
850—Warburton, Joshua, 18, Manchester M.I., clerk—Arith. (1st)
242—Ward, Charles W., 18, Christchurch W.M. Inst., tailor's apprentice—Eng. Hist. (3d)
1030—Ward, George E., 16, Reeth M.I., printer and bookbinder—Arith. (3d)
122—Ward, John, 22, Bolton M.I., mechanic—Chem. (3d)
1345—Ward, Sampson, 22, Bradford M.I., woolsorter—Geog. (1st); Arith. (3d)
77—Ward, Thomas, 22, Banbury M.I., commercial clerk—Botany (2d)
1245—Ward, Thomas, 44, Leeds Church Inst., teacher—Music (2d)
911—Warden, William, 19, Newcastle-on-Tyne M.I., clerk—Dom. Econ. (2d)
265—Wardle, David Taylor, 17, Dean Mills Inst., mechanic—Arith. (3d)
812—Wardrop, Thomas, 21, Manchester M.I., clerk—Arith. (2d)
745—Warren, Frederick, 18, London M.I., clerk—Arith. (3d)
907—Waterhouse, Joseph, 18, Mossley M.I., weaver—Bkpg. (2d)
707—Waters, William, 19, City of London Coll., Arith. (1st); Geog. (2d)
105—Watson, Frederick John, 20, Birm. and Midland Inst., grocer—French (3d)
1093—Watson, John, 19, Slough M.I., bookbinder's assistant—Freehand dwg. (3d)
715—Watson, John Rowland, 25, R. Polytechnic Local Board, clerk—Logic (2d)
1092—Watson, Joseph, 21, Slough M.I., clerk—Geom. dwg. (1st); Freehand dwg. (3d)
490—Watson, Matthew, 18, Glasgow M.I., clerk—Bkpg. (2d)
708—Wentzell, George R., 20, City of London Coll., stationer's assistant—French (3d)
306—Westlake, George J., 16, Devonport M.I., engineer (student)—Arith. (3d)
543—Wheeler, Edwin, 17, Hitchin M.I., pupil teacher—Arith. (2d)
524. Whitaker, Arthur Baines, 29, Halifax W.M.C., gas meter inspector—Chem. (2d)
1353—Whitaker, James, 18, Rawtenstall M.I., book-keeper—Bkpg. (3d)
738—White, Andrew T., 17, Royal Polyt. Inst., upholsterer—Arith. (1st); Bkpg. (2d)
1339—White, Edwin, 19, Bradford M.I., warehouseman—Arith. (3d); Eng. Hist. (2d)
1151—White, Fanny A., 17, Messrs. Chance's Lib., pupil teacher—Arith. (3d)
307—White, Henry G., 23, Devonport M.I., shipwright—Nav. and Naut. Ast. (1st) with 1st prize; Trig (2d); Mens. (2d)
847—Whitehead, William H., 21, Manchester M.I., warehouseman—Arith. (2d); Bk-kpg. (1st)
902—Whitworth, Robert, 20, Mossley M.I., piecer—Bkpg. (3d)
898—Whitworth, Samuel, 27, Mossley M.I., cotton piecer—Bkpg. (2d)
320—Wick, Emanuel, 18, Faversham Inst., pupil teacher—Arith. (3d); Eng. Hist. (3d); Geog. (3d)
337—Wilkie, John, 18, Pop. Evg. Classes, And. Univ., Glasgow, clerk—Mining and Met. (2d)
231—Wilkins, George, 22, Chatham, &c., M.I., carpenter—Mens. (3d)
227—Wilkins, William, 18, Chatham, &c., M.I., clerk Bkpg. (2d); Alg. (1st) with 1st prize
1334—Wilkinson, Swaine, 23, Bradford M.I., warehouseman—Eng. Lit. (1st); Logic (1st); Eng. Hist. (2d)
1129—Willetts, John, 24, Cradley Heath W.M. Club, clerk—Arith. (3d)
773—Williams, William J., 16, St. Stephen's (Westm.) Evg. School, clerk—Bkpg. (2d)
1081—Williamson, John, 17, Salford W.M. Coll., clerk—Bkpg. (2d)
1182—Willis, Alfred, 25, Willenhall Lit. Inst., shoe dealer and organist—Music (1st)
1300—Wilson, Albert W., 20, York Inst., railway clerk—Alg. (2d)
525—Wilson, Benjamin C., 22, Halifax W.M.C., woolsorter—Bkpg. (2d)
526—Wilson, Clarke, 19, Halifax W.M.C., brushmaker (apprentice)—Arith. (2d); Bkpg. (1st)
1098—Wilson, Frederick Waters, 19, Slough M.I., carpenter (apprentice)—Geom. Dwg. (2d)
356—Wilson, James, 22, Pop. Evg. Classes, Anders. University Glasgow, draughtsman—Geom. (3d)

422—Wilson, Thomas, 19, Glasgow M.I., clerk—Bkpg. (1st)
716—Wilson, Thomas, 23, R. Polytechnic Local Board, clerk—Logic (1st), with 2d prize
1307—Windass, John, 22, York Inst., painter—Geom. Dwg. (3d)
49—Wolfenden, Joshua Lord, 24, Bacup M.I., weaver Anim. Phy. (3d)
854—Wood, David W., 19, Manchester M.I., clerk—Eng. Hist. (3d)
939—Wood, John, 18, Oldham Lyc., clerk—Arith. (2d)
987—Wood, Robert, 16, Paisley Artizan's Inst., clerk—French (3d)
833—Wood, Thomas, 18, Manchester M.I., warehouseman—Arith. (1st)
528—Woodhead, David, 19, Halifax W.M.C., oil-cloth maker—Bkpg. (2d)
1162—Woodhouse, Thomas J., 18, Stourbridge Ch. of Eng. Young Men's Assoc., civil service (proposed)—Arith. (3d); Geog. (3d)
711—Woodley, Thomas, 35, City of London Coll.—Arith. (2d); Bkpg. (2d)
566—Woods, William Garrard, 16, Ipswich W.M.C., merchant's clerk—Bkpg. (2d)
106—Woolley, Jane Eleanor, 18, Birm. and Midl. Inst., governess—Eng. Hist. (3d)
746—Worth, Henry, 25, London M.I., photographic appar. maker—Arith. (2d); Geog. (2d); Alg. (3d)
308—Wotton, George Gilpen, 21, Devonport M.I., attorney's clerk—Bkpg. (1st); Arith. (3d)
920—Wright, John Thomas, 20, Werneth M.I., clerk—Bkpg. (1st) with 1st prize; Trig. (2d); Mens. (2d)
1236—Wright, John W., 20, Leeds M.I., chemist's assistant—Chem. (3d)
72—Wright, Richard Joseph, 18, Banbury M.I., pupil teacher—Eng. Lit. (1st); Eng. Hist. (2d)
530—Wright, William, 29, Hastings M.I., gasfitter—Arith. (2d); Chem. (3d)
968—Wrigley, Wm., 19, Oldham Science Sch., knotter—Geom. Dwg. (3d)
1191—Wynn, William, 20, Wolverhampton W.M. Coll., clerk—Arith. (1st)
330—Valentine, William, 24, Gilford Y. Men's Mut. Imp. Soc., clerk—Bkpg. (1st)
706—Vaughan, William, 24, City of London Coll., clerk—Navig. and Naut. Ast. (1st) with 2d Prize; Princ. Mech. (1st), with 1st Prize
1136—Vickrage, William H., 16, Woodside Y. Men's Mut. Imp. Soc., pupil teacher—Arith. (2d)
1128—Vokes, Thomas Bouchier, 20, Southampton Ath., clerk (Ordnance Survey)—Arith. (1st)
757—Vousden, Joseph F., 19, St. Michael's (Bromley) Evg. Classes, clerk—Arith. (1st); Bkpg. (1st)
1085—Yates, George, 20, Salford W.M. Coll., clerk—Arith. (3d)
1205—Yeamon, Nicholas, 33, Wolverhampton W. Men's Coll., teacher—Arith. (2d)
309—Yeo, John, 17, Devonport M.I., engineer (student)—Arith. (1st); Alg. (1st)
1185—Young, Hannah E., 26, Wolverhampton Ath., private schoolmistress—Eng. Lit. (1st); Eng. Hist. (2d)
712—Young, Walter, 24, City of London Coll., clerk—French (3d)
390—Young, William Gillies, 36, Glasgow Ath., clerk—French (3d); also as 427—Glasgow M.I.—Spanish (3d)

PARIS EXHIBITION OF 1867.

The following is a list of the Commissioners appointed by Her Majesty to advise her upon the best mode by which the products of industry and the fine arts of the United Kingdom, the British Colonies and Dependencies may be procured and sent to this Exhibition, viz.:—

The Prince of Wales, K.G.; Earl Granville, K.G., President of the Council; The Duke of Buckingham and Chandos; the Duke of Sutherland, K.G.; the Marquis of Lansdowne, K.G.; the Marquis of Salisbury, K.G.; the Marquis of Hertford, K.G.; the Earl of Derby, K.G.; the Earl of Rosse; Earl Cowley, G.C.B.; Earl Russell, K.G.; the Rt. Hon. Lord Stanley, M.P.; Lord Elcho, M.P.; Lord Portman; Lord Overstone; Lord Taunton; Lord Houghton; the Rt. Hon. Edward Cardwell, M.P., Secretary of State for the Colonies, or the Secretary of State for the Colonies for the time being; the Rt. Hon. Sir John Pakington, Bart., G.C.B., President of the Institute of Naval Architects, or the President of the Institute of Naval Architects for the time being; the Rt. Hon. Sir Charles Wood, Bart., K.C.B., M.P., Secretary of State for India in Council, or the Secretary of State for India in Council for the time being; the Rt. Hon. W. F. Cowper, M.P., Chief Commissioner of Works, or the Chief Commissioner of Works for the time being; the Rt. Hon. W. E. Gladstone, Chancellor of the Exchequer, or the Chancellor of the Exchequer for the time being; Sir George Clerk, Bart.; the Rt. Hon. Benjamin Disraeli, M.P.; the Rt. Hon. Robert Lowe, M.P.; the Rt. Hon. C. B. Adderley, M.P.; the Rt. Hon. H. A. Bruce, M.P.; Sir Stafford H. Northcote, Bart., C.B.; Sir Clarence Kerrison, Bart., President of the Royal Agricultural Society, or the President of the Royal Agricultural Society for the time being; Sir Alexander Y. Spearman, Bart.; Sir S. M. Peto, Bart.; Sir C. Wentworth Dilke, Bart.; Sir Roderick Impey Murchison, K.C.B.; Sir Charles L. Eastlake, President of the Royal Academy, or the President of the Royal Academy for the time being; Sir Francis R. Sandford; Lyon Playfair, Esq., C.B.; Edgar A. Bowring, Esq., C.B.; Warren Stormes Hale, Lord Mayor of London, or the Lord Mayor of London for the time being; Charles Lawson, Lord Provost of Edinburgh, or the Lord Provost of Edinburgh for the time being; John Barrington, Lord Mayor of Dublin, or the Lord Mayor of Dublin for the time being; Edward Akroyd, Esq., Chairman of the Chamber of Commerce of Halifax, or the Chairman of the Chamber of Commerce of Halifax for the time being; Henry Ashworth, Esq., late President of the Chamber of Commerce of Manchester; Charles Atkinson, Esq., the Master Cutler of Sheffield, or the Master Cutler of Sheffield for the time being; Thomas Baring, Esq., M.P.; Thomas Bazley, Esq., M.P.; Somerset A. Beaumont, Esq., M.P., Chairman of the Chamber of Commerce of Newcastle-on-Tyne, or the Chairman of the Chamber of Commerce of Newcastle-on-Tyne for the time being; George Thomas Clark, Esq.; Thomas Pearson Crossland, Esq., President of the Chamber of Commerce of Huddersfield, or the President of the Chamber of Commerce of Huddersfield for the time being; Thomas L. Donaldson, Esq., President of the Royal Institute of British Architects, or the President of the Royal Institute of British Architects for the time being; Thomas Fairbairn, Esq.; Charles Forster, Esq., M.P.; William H. Gregory, Esq., M.P.; Thomas Field Gibson, Esq.; William J. Hamilton, Esq., President of the Geological Society, or the President of the Geological Society for the time being; William Hawes, Esq., Chairman of the Council of the Society of Arts, or the Chairman of the Council of the Society of Arts for the time being; Lewis Heymann, Esq., Chairman of the Chamber of Commerce of Nottingham, or the Chairman of the Chamber of Commerce of Nottingham for the time being; Michael D. Hollins, Esq., Chairman of the Chamber of Commerce of the Potteries, or the Chairman of the Chamber of Commerce of the Potteries for the time being; Darnton Lupton, Esq., Chairman of the Chamber of Commerce of Leeds, or the Chairman of the Chamber of Commerce of Leeds for the time being; John Robinson M'Lean, Esq., President of the Institute of Civil Engineers, or the President of the Institute of Civil Engineers for the time being; James Macauley, Esq., President of the Chamber of Commerce of Belfast, or the

President of the Chamber of Commerce of Belfast for the time being; John M'Ewen, Esq., Chairman of the Chamber of Commerce of Glasgow, or the Chairman of the Chamber of Commerce of Glasgow for the time being; John Francis Maguire, Esq., M.P.; Philip W. S. Miles, Esq., President of the Chamber of Commerce of Bristol, or the President of the Chamber of Commerce of Bristol for the time being; John Moreton, Esq., Chairman of the Chamber of Commerce of Wolverhampton, or the Chairman of the Chamber of Commerce of Wolverhampton for the time being; Robert Napier, Esq., President of the Institute of Mechanical Engineers, or the President of the Institute of Mechanical Engineers for the time being; Philip Henry Rathbone, Esq., President of the Chamber of Commerce of Liverpool, or the President of the Chamber of Commerce of Liverpool for the time being; Richard Redgrave, Esq., R.A., H.M.'s Surveyor of Pictures; Henry W. Ripley, Esq., Chairman of the Chamber of Commerce of Bradford, or the Chairman of the Chamber of Commerce of Bradford for the time being; Richard Russell, Esq.. President of the Chamber of Commerce of Limerick, or the President of the Chamber of Commerce of Limerick for the time being; Major-General Edward Sabine, President of the Royal Society, or the President of the Royal Society for the time being; Wm. Scholefield, Esq., President of the Chamber of Commerce of Birmingham, or the President of the Chamber of Commerce of Birmingham for the time being; John Sharp, Esq., President of the Chamber of Commerce of Dundee, or the President of the Chamber of Commerce of Dundee for the time being; Frederick Tayler, Esq., President of the Society of Painters in Water Colours, or the President of the Society of Painters in Water Colours for the time being; Henry Thring, Esq.; Henry Hussey Vivian, Esq.; and Henry Cole, Esq., C.B., Secretary.

The Commissioners held their first meeting in the Lecture Theatre of the South Kensington Museum on Saturday, the 27th May. His Royal Highness the Prince of Wales presided. The Commissioners decided to divide themselves into twelve or more sub-committees, to take charge of the various groups into which the exhibition will be classified.

Fine Arts.

The Exhibition of Portrait Miniatures, consisting of between three and four thousand specimens of all the great masters, from the time of Holbein, will be opened to the public at the South Kensington Museum to-morrow (Saturday).

Manufactures.

Preservation of Flowers with their Natural Colours.—Dried flowers, in their natural colours, have for some time past appeared for sale in the shops; the mode in which the operation is effected is this:—A vessel, with a moveable cover, is provided, and having removed the cover from it, a piece of metallic gauze of moderate fineness is fixed over it, and the cover replaced. A quantity of sand is then taken sufficient to fill the vessel, and passed through a sieve into an iron pot, where it is heated, with the addition of a small quantity of stearine, carefully stirred, so as to thoroughly mix the ingredients. The quantity of stearine to be added is at the rate of half a pound to one hundred pounds of sand. Care must be taken not to add too much, as it would sink to the bottom and injure the flowers. The vessel with its cover on, and the gauze beneath it, is then turned upside down, and the bottom being removed, the flowers to be operated upon are carefully placed on the gauze and the sand gently poured in, so as to cover the flowers entirely, the leaves being thus prevented from touching each other. The vessel is then put in a hot place, such for instance as the top of a baker's oven, where it is left for forty-eight hours. The flowers thus become dried, and they retain their natural colours. The vessel still remaining bottom upwards, the lid is taken off, and the sand runs away through the gauze, leaving the flowers uninjured.

Notes.

Paris Exhibition of 1867.—The amount of the guarantee asked for, namely, eight millions of francs, has been subscribed, the large companies, some bankers, and many rich manufacturers having taken up the matter very energetically. The sum named above was that fixed as the maximum, but the amount was not limited, the subscription will therefore be left open for some time. The appointment of the remaining nineteen members of the commission, who will be the representatives of the guarantors, is to take place by the end of the present month.

Public Works in France.—The Government has opened a credit of 360,000,000 francs, to be raised by the sale of crown lands during the coming six years, and devoted in the following manner:—For roads and bridges, 95 millions; rivers, 63 millions; canals, 32 millions; maritime ports, 135 millions; hydraulic works and agricultural improvements, 35 millions. Amongst the other works in contemplation are two canals, one to make a direct communication between Paris and Pontoise, passing through the valley of Montmorency; starting from the Oise, near Saint Ouen l'Aumône, it will traverse Herbelay, Montigny, Franconville, Epinay, Saint Denis, and Aubervilliers, where it will cross the canal of Saint Denis; the other is to be an embankment of the former, commencing at Herbelay, and ending at Conflans Sainte Honorine.

The Bombay International Exhibition is now to be carried out (says the *Bombay Gazette*) on a system of guarantees, and the Joint-Stock Company is to be wound up. Mr. T. C. Hayllar has been appointed managing director in Bombay.

Crystal Palace at Oporto.—The Portuguese journals state that an edifice, entirely composed of glass and iron, in the style of the Crystal Palace at Sydenham, is about to be erected at Oporto, on the hill of Torre di Marca, just outside the town. It is intended for the exhibition of all the productions of Portuguese industry, as well as the natural products of the country.

Correspondence.

ON THE WEAR AND TEAR OF STEAM BOILERS.

Sir,—While reminding Mr. D. K. Clark that iteration is not argument, and also that to ignore is not to answer arguments, I beg to refer anybody who cares about the previous questions to my letter in your last current number but one. As Mr. Clark has now quoted that passage of his book by which he claims to have forestalled what I have written on the mechanical effects of heat on steam boilers, I will, in the same way as with regard to pitting and furrowing, now prove, in an easily accessible form—

1. That my explanations, such as they are, of the mechanical effects of heat in the wear and tear of boilers, are quite distinct from those given by Mr. D. K. Clark;

2. That everything which he adduces as explanatory of these effects was published by others years before the issue of his work on the "Recent Practice in the Locomotive Engine;"

3. That such publication was perfectly well known to Mr. D. K. Clark at the time (1860) he published his own book;

4. That the information I have derived from other people has been fully acknowledged by myself.

I will now proceed to prove these small matters by *verbatim* references to the original documents:—

Mr. D. K. Clark's Theory (*in extenso*) of the Mechanical Effects of the Heat on the Wear and Tear of Boilers.

(Your Correspondent's Explanation will be found at pp. 391-2 of the *Journal* for April 28th.)

At page 17 of "Recent Practice in the Locomotive Engine," published in 1860, Mr. D. K. Clark says:—

"Copper expands by heat half as much again as iron, and taking the mean temperature of the copper of the fire-box at twice as much as that of the shell, an assumption which, we suppose, is something much below the fact, the vertical expansion of the fire-box would be, upon the whole, three times as much as that of the shell, and the difference of expansion would be twice that of the iron, or at the rate of 1 in 500. On a fire-box 5ft. 3in. high, the difference of expansion would, at this rate, amount to one-eighth of an inch. That is to say, the upper stay bolts would be deflected one-eighth of an inch from their normal position when under the power of high-pressed steam. On a length of stay bolt of 3 in., a deflection of one-eighth of an inch is immoderate; and, considering the alternate expansion and contraction, bending and relaxing, attendant upon getting up steam and letting it down, it is reasonable to conclude that the same cause of degradation is at work with the stay bolts as that already suggested for boiler plates at the rivet joints—the alternation of strain, tension, and relaxation, which loosens the texture and ultimately overpowers the cohesion of the material so treated, incurring partial fracture and accelerated corrosion. On this argument the failure of stay bolts should—as in fact it is—be localised at or near their junctions with the plates, which are the points of maximum strain, similarly to the localisation of furrows near rivet joints. Occasionally, entire rows of rivets are found to have snapped across close to the plate, independently of corrosive action, suggesting a cause of failure precisely the same as that which breaks axles, an alternating lateral strain and relaxation beyond the limits of enduring elasticity. . . . .

"The reasons above advanced afford an explanation of the fact that fire-boxes with narrow water spaces are more subject to leakage than those with wider spaces, the stays being shorter and less flexible in the former case, and likelier to fail. For the same reasons, stay bolts of smaller diameter, sufficiently strong, are preferable to others of larger diameter. They are more elastic, and yield to unequal expansion more readily than thicker stays, and are, therefore, likely to be more durable.

"The oblique strain to be resisted is similar in character to that which tells upon weak wrought iron-wheel spokes under excessive shrinkage of tyres converting them into serpentine and ægie forms, as the duration of wheel spokes, under such circumstances, is increased by expanding them towards their junction with the nave and with the rim, and rounding them in; so that if stay-bolts are improved by turning off the thread in the middle part, now sometimes done, probably the application of the principle might be advantageously extended; and our belief is that a superior iron stay-bolt may be made more or less of the forms (see figure) in which a ⅞in. screw is turned down to ½in. or ⅝in. diameter at the middle."

When I first read the above explanations, coupled with the proposed remedy, I was greatly struck with them. Little did I then know that Mr. D. K. Clark has not the slightest claim to originality in the whole matter. Both the disease and its remedy have been described years before the publication of Mr. Clark's work.

In "Colburn's Railway Advocate" (New York), No. 25, for the 27th of October, 1855, page 2, we read, under the heading of "Breakage of Boiler Stay-bolts:"—

"An attentive friend, Mr. George Richards, at the repair shop of the Boston and Providence-road, at Roxbury, Mass., writes us in regard to the above subject, and advances the explanation that the difference in the expansion of the inside and outside fire-box shells is one, if not the only, cause of the breaking of stay-bolts. His letter, which we copy below, deserves attention, as the facts which he presents tend to establish the correctness of his views.

"'A boiler has been recently examined at the Boston and Providence railroad shop, and many of the screw stay-bolts were found broken close to the outside sheet. This engine has been in almost constant use for upwards of eight years. The bolts were not wasted away at all, but broken short off. Other boilers have been examined previous to this, and bits were found broken in the same manner; the broken bolts were invariably in the upper rows. His evidence goes to prove that the cause of the breaking of the bolts is the different expansion of inside and outside sheets of fire-box, as the upper bolts are subject to more of that expansion. The screw also helps to break the bolts. The engine spoken of has been fired up and cooled off at least two thousand times; consequently, the stay-bolts have been strained that same number of times, besides being subject to the usual boiler pressure. Mr. Griggs has been supplying the places of the broken bolts with new ones, which he has turned down a little below the thread, between the sheets, which will allow them to spring, as the inside fire box expands upwards more than the inside. If the different expansion of the sheets is the cause of the bolts breaking, I think that they will not break if used long enough.'"

It seems to me that anybody who chooses to compare Mr. D. K. Clark's account with mine must feel as astounded as myself at his statement, that, "*my* explanation of the destructive action of the unequal expansion of the fire-box of locomotives, and the shell, upon the stay bolts, in straining them laterally beyond the limits of elasticity, and thus permanently weakening them, was published at the same time ['Recent Practice,' pp. 16, 17], and, I think, anticipates *all* that Mr. Paget has just written on the same subject." This astonishment would of course arise even on the supposition of the existence of originality of conception on his part,—in fact, notwithstanding the extraordinary coincidence that the diagnosis of the disease and its remedy, both put forward as his own by Mr. Clark, were both published years previous. It might, perhaps, be said that he could not be expected to know what had been published in a New York periodical. But what will be really said when I mention that Mr. Zerah Colburn, the then editor of the New York "Railroad Advocate," distinctly affirms to me that he sent that very number, and other numbers, to Mr. D. K. Clark? Besides, the columns of Mr. Colburn's periodicals, containing, as they do, letters from Mr. D. K. Clark, bear public testimony to a correspondence of that date between these two gentlemen. Again, that portion of "Recent Practice in the Locomotive Engine," written by Mr. Colburn, includes the same statements.

It is, however, just possible that, by some chance, or rather miracle—and miracles are events beyond the doctrine of chances—Mr. Clark, without having seen Mr. Griggs' remarks, published five years previous, may have evolved the whole from his own "internal consciousness." F. A. Paget.

18, Adam-street, Adelphi, 27th May.

Anchors and Chain Cables.—Sir,—In your report of the discussion on Mr. Gladstone's paper, you have made me responsible for the production of steel anchors and cables at £25 per ton, whereas I stated that *cast steel* anchors could be manufactured at from £55 to £75, and *puddle steel* cables at £25 per ton, the latter of the same size, but of nearly double the strength, as the iron cables represented in Mr. Gladstone's paper as costing £15. Please correct this, and oblige,—Yours, &c., T. A. Rochussen.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Entomological, 7.
R. United Service Inst., 8½. 1. Mr. Charles Atherton, "On Unsinkable, or Raft Shipping." 2. Mr. J. C. Clarkson, "On the Application of Clarkson's Patent Cork Material for Naval and Military Purposes."
Royal Inst., 2. General Monthly Meeting.
Odontological Society, 8.

Tues. ...Anthropological, 8.
Royal Inst., 4. Mr. Edwin Chadwick, "On the Physical and Moral Condition of the English Wage Classes."

WED....Geological, 8.
R. Society of Literature, 8½.
THURS...Antiquaries, 8.
Royal Inst., 4, Mr. Edwin Chadwick, "On the Physical and Moral Condition of the English Wage Classes."
FRI.......Astronomical, 8.
Royal Inst., 8. Professor Frankland, "Latest Researches in Organic Chemistry."
SAT.......R. Botanic, 3¾.
Royal Inst., 4. Mr. Edwin Chadwick, "On the Physical and Moral Condition of the English Wage Classes."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 18th May, 1865.*

145. Bills—Dockyard Extensions.
149. ,, General Post Office (Additional Site) (as amended by the Select Committee).
150. ,, County Courts Equitable Jurisdiction.
65 (VIII). Committee of Selection—Ninth Report.
165. Lighthouses (Isle of Man)—Correspondence.
247. Western Australia—Letter.
262. Jersey Royal Court—Extracts of Further Correspondence.
268. Ecclesiastical Commission (Ireland)—Annual Report and Account.
284. Post Office (Letter Carriers, &c.)—Return.
287. Railways (Ireland)—Letter.
291. Harbours of Refuge—Detailed Statement.
New Zealand—Further Papers.

Delivered on 19th May, 1865.

141. Bill—Prisons (as amended by the Select Committee) (corrected Copy).
265. Exchequer—Account.
273. Mercantile Marine Fund—Account.
280. Prisons Bill—Minutes of Proceedings.
281. Poor Law Unions—Return.

Patents.

From Commissioners of Patents Journal, May 26th.

GRANTS OF PROVISIONAL PROTECTION.

Bessemer steel ingots—1100—T. Hampton and J. Abbott.
Blacking, vessels for containing—1327—T. Davis.
Bleaching fibrous material—1144—W. Clark.
Boilers, steam—988—G. Rydill.
Breweries, apparatus employed in—1204—F. Gregory.
Buttons—1294—H. W. Hart.
Cables, links for chain—1250—W. Roberts.
Cardboard, apparatus for making—1365—W. Haigh.
Carriage step—1290—S. L. and A. Fuller and C. Martin.
Candles, paraffin—1286—J. H. Johnson.
Cannon, cartridges for—1300—J. J. Revy.
Chains, apparatus for testing the strength of—1347—J. Tangye.
Chaplet—1333—H. J. Burt.
Churns—1292—W. E. Broderick.
Collodion, manufacture of—1313—A. Parkes.
Corn drill—1345—H. Besley.
Cotton, hydraulic presses for compressing—1254—G. Peel & I. Mason.
Cotton, machinery for stretching—1317—J. Hesford.
Croquet stand—1214—W. T. W. Jones.
Cylinders, packing for steam—1112—E. T. Hughes.
Fabrics, apparatus for stretching woven—1239—W. Clark.
Fabrics, manufacture of flock—1218—W. E. Newton.
Fire-grates—1270—J. Buchanan.
Fire-arms, breech loading—1136—P. A. le C. de Fontaine-Moreau.
Fire-arms, breech loading—1276—S. Law.
Fire-arms, apparatus to be used with breech loading—1355—P. C. Lafont.
Furnaces, water twyers for blast—722—N. N. Solly.
Gas—1266—I. Swindells.
Gas meters—1296—E. Myers.
Generators, steam—1210—J. H. Johnson.
Glass, manufacture of—1220—A. H. Emerson and R. Fowler.
Gun cotton, preparation of—1102—F. A. Abel.
Gun barrels—1341—W. Deakin.
Hatblocks, machinery for shaping—258—W. H. Higgins.
Hinges—1335—William Clark.
Hose, manufacture of—1309—T. J. Mayall.
Hydrocarbons, apparatus for distilling—1361—G. Walton.
Jacquard machines—1298—J. Melvin.
Jute, preparation of—1262—J. McGlashan.
Lamps—1268—W. C. Cropp.
Land, machinery for cultivating—1134—J. Howard and E. T. Bousfield.
Leather, tanning—1126—E. S. Beaux and E. Paunifex.
Lithographic impressions, producing—1325—G. and G. W. Simmons.
Locks—1201—W. Clark.
Locks—944—R. Nabbs.
Locomotives, wheels for—1114—W. Day.
Luggage, balance for weighing—115—A. C. Herrmann.
Moulds for casting pipes—1206—D. Y. Stewart.
Oil, vessels for containing—1359—S. Svendson.
Peas, apparatus for shelling—1244—E. G. Smith.
Pencils, manufacture of—1339—J. F. Cooke.
Pipes, apparatus for cutting metal—1311—G. Mountford and E. Worroll.
Ploughs—1246—J. Stalkartt.
Portraits, materials for producing—1184—A. Grainger & C. Mitchell.
Printing machinery—1026—D. Payne.
Pulleys, spring apparatus for—1343—G. Elliott and B. Coxon.
Railway trains, communication between passengers and guard of—1030—J. H. Johnson.
Railways, apparatus for laying single line—1321—R. Winder.
Railways, effecting traction on—1323—R. E. Donovon & D. O'Brien.
Railway trains, communication by signals between different parts of—1353—M. Defries.
Rivets, machinery for making—1357—R. Leddicoat.
Roads, constructing—1260—J. Mitchell.
Safety-valve—1305—J. H. Johnson.
Safety lamps—1274—J. H. Johnson.
Sewing machines—1166—J. and W. Fairweather.
Sewing machines—1331—J. K. Caird.
Ships, &c., construction of—1083—W. Bedder.
Signals, machinery for transmitting—1258—A. H. Brandon.
Slabs, manufacture of—1337—F. Ransome.
Spirits, apparatus for measuring—1272—J. H. Johnson.
Soles, clogs and patten—1351—W. Brown.
Starch, treating rice for manufacture of—1319—H. Ransford.
Stays, fasteners for—1284—G. Hartley.
Steam engines—1264—W. E. Newton.
Tubes, apparatus for fixing—1282—R. H. Tweddell.
Type, machinery for distributing—1252—A. Mackie, H. Garside, and J. Salmon.
Type, machine for dressing printer's—1277—P. Welsh.
Umbrellas, metal ribs for—1302—R. Hadfield and J. Shipman.
Vessels, propellers for—1138—R. H. Dart.
Vessels, composition for coating—1278—J. C. C. Halkett.
Vinegar, brewing—1263—S. Bennett.
Water, process for purfying—1242—C. G. Lenk.
Wheels, railway—1158—J. T. Buckhill.
Wires, apparatus for tapering—1363—C. O. Crosby.

INVENTION WITH COMPLETE SPECIFICATION FILED.

Machines, rotary magneto electric—1368—T. Faucheux.
Oils, lamps for burning mineral—1410—P. A. le C. de Fontaine-Moreau.
China, clays for the manufacture of—1414—A. Hett.

PATENTS SEALED.

2981. R. F. Dale.
2987. F. B. Dœring.
2989. A. Hawkes.
2894. F. A. Wilson.
2999. J. Neat.
3009. E. A. Cowper.
3018. C. W. Siemens.
3036. G. Dixon.
3052. W. Husband & J. Quick.
306. J. R. Webb.
309. S. W. Wood.
540. E. H. Eldridge.
556. S. S. Grey.
588. W. S. Thomson.
734. S. D. Boulton.

From Commissioners of Patents Journal, May 30th.

PATENTS SEALED.

2869. R. G. Grimes.
2997. J. Sax.
3003. M. J. Roberts.
3004. S. P. Kittle.
3007. G. Wallis and B. Cooper.
3008. W. Pollock.
3011. J. France.
3012. J. K. Crawford.
3016. J. W. Proffitt.
3032. A. Blampoil.
3034. W. E. Gedge.
3038. T. Archer.
3080. F. G. Mulholland.
3101. P. F. Lunde.
3159. T. A. Grimston.
3175. J. H. Johnson.
3204. J. Rowberry.
2. T. A. Macaulay.
142. S. J. Best & J. J. Holden.
205. R. R. Riches and C. J. Watts.
549. W. Sim.
623. T. S. Sperry.
691. J. Henderson.
794. H. S. Jacobs.
903. W. Milner and D. R. Ratcliff.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1554. P. McGregor.
1616. W. Perks.
1566. W. & J. Harrison, J. Oddie, and W. Parkinson.
1573. W. Worby.
1609. J. A. Ransome.
1595. C. H. Hudson.
1585. J. Ireland.
1594. G. H. Daw.
1603. T. Turner.
1605. J. Hirst & E. O. Taylor.
1611. J. Hirst and J. Wood.
1598. J. Simpson.
1646. J. Betteley.
1655. J. King.
1694. J. Bell.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1155. R. L. Hattersley.
1169. G. Alton and J. Firnie.
1193. C. Cowper.
1318. T. Chatwin and C. Taylor.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, JUNE 9, 1865. [No. 655. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Conversazione.

The Council have arranged for a Conversazione on Wednesday, the 14th June, at the South Kensington Museum, cards for which have been issued.

Dinner.

Some of the Vice-Presidents and Council propose to dine together on Monday, the 26th inst. Any Members of the Society desiring to join the party are requested to communicate with the Secretary forthwith.

Tickets (one guinea each) will be ready for delivery at the Society's house on and after Friday next, the 16th inst., but application should be made without delay, in order to facilitate the arrangements.

Annual Conference.

The Fourteenth Annual Conference between the Council and the Representatives of the Institutions in Union and Local Boards will be held on Wednesday next, the 14th June, at Twelve o'clock, noon. William Hawes, Esq., Chairman of the Council, will preside.

Secretaries of Institutions and Local Boards are requested to send, as soon as possible, the names of the Representatives appointed to attend the Conference.

The Council will lay before the Conference the Secretary's Report of the Proceedings of the Union for the past year, and the Results of the Examinations, as well as the Programme of Examinations, Elementary and Final, for 1866.

The following subjects are suggested for discussion:—

1. The establishment of organising teachers among the Institutes, on the plan adopted in the East Lancashire Union.
2. Is any modification of the present scheme of Elementary Examinations, by rendering it more adapted to the capacities of class pupils in Mechanics' Institutes, desirable?
3. The advantages of local prizes to successful candidates, at the Society of Arts' Examinations, as a stimulus to local competition.
4. Whether any special inducements can be held out to lead soldiers to avail themselves of the Society's Examinations? [See the subjoined correspondence with His Royal Highness the Field-Marshal Commanding-in-Chief.]
5. The propriety of adding to the Society's Examinations the subject of "Practical Gardening," in accordance with a proposal made to the Council by the Royal Horticultural Society, who have expressed their willingness to offer prizes in this subject.
6. How can Institutions promote the Physical Education of their members?
7. How may Popular Readings and Entertainments be made to promote the efficiency of Institution Classes?
8. The advantage of Garden Allotments, as a feature of the Institute, with the view of healthful recreation for the members.
9. Should Institutes promote the establishment of Horticultural Shows, Building Societies, Penny Savings Banks, and similar movements towards the social amelioration of the people?
10. The advantages and disadvantages of subscriptions to Institutes being paid by weekly or other small amounts.

Notice should be given to the Secretary of the Society of Arts of any other subjects which Institutions or Local Boards may desire their Representatives to introduce to the notice of the Conference.

Representatives of Institutions and Local Boards attending the Conference are invited to the Society's Conversazione, at the South Kensington Museum, on the evening of the same day (14th June), and will receive cards on application at the Society's House, on the day of the Conference.

Secretaries of Institutions are requested to forward, *at once*, by book post, copies of the last Annual Reports of the Institutions.

Examination of Soldiers.

The following documents have been forwarded to the District Unions, Local Boards, and other Institutions connected with the Society:—

The first is a letter to Field-Marshal His Royal Highness the Commander-in-Chief of the Army, from Mr. Harry Chester, inquiring whether his Royal Highness would see any objection to his announcing, at a public meeting then intended to be held at Knightsbridge,

that the examinations and classes held by the Boards and Institutions connected with this Society, were open to soldiers, their wives, and children, as well as to civilians of the working classes. It will be seen that Mr. Chester, though asking this question for his own guidance, couches it in such general terms, that the answer will serve equally for all others engaged in carrying out the scheme of examinations wherever the Society has Local Boards in any part of the kingdom. The letter was referred by the Commander-in-Chief to the Council of Military Education, for their consideration and report.

The second document is General Forster's reply to the above-mentioned letter. Before this reply was given, Mr. Chester's illness had compelled him to go abroad, under strict injunctions to abstain entirely from business, and there was no means of making known the correspondence until it was too late for the examinations of 1865.

The third document is an official memorandum recently published by command of His Royal Highness, to the same effect as General Forster's letter. The authorities of the District Unions, Local Boards, and Institutions connected with the Society will naturally see the propriety of abstaining from addressing themselves directly to the troops quartered in any place, and will in every case apply to the commanding officer, and leave it to him to determine whether and in what manner the subject shall be brought to the notice of those under his command.

I.

63, Rutland-gate, Dec. 30, 1864.

Sir,—Your Royal Highness is probably acquainted with the measures which have been taken by the Society of Arts since the Great Exhibition of 1851, to promote the education of adults of the working-classes employed in "Arts, Manufactures, and Commerce."

The Society's "Union" of Institutions for the education of adults embraces about 1,000 Institutes, Evening Schools, and "Local Boards." The latter, about 150 in number, have been called into existence expressly to carry out the scheme of educational examinations which has been established by the Society and the Institutions united thereto.

His Royal Highness the Prince Consort was pleased to take a lively interest in this scheme; and a prize of 25 guineas, which he established, "The Prince Consort's Prize," is now given annually by Her Majesty the Queen.

The scheme extends to all parts of the United Kingdom wherever a local board can be formed.

In many parts of England district unions have been formed for the better carrying out of the scheme.

A district union, called the Metropolitan Association for Promoting the Education of Adults in Union with the "Society of Arts," was formed about two years ago. Of this Association His Royal Highness the Prince of Wales (President of the Society of Arts) is patron and a life member; and Her Royal Highness the Princess of Wales is patroness, and gives an annual prize to female candidates. Earl Granville is President.

The examinations are of two kinds. There are examinations of persons not under 16 years of age, in 32 different subjects, by examiners appointed by the Society of Arts, and preparatory examinations, of persons not under 12 years of age, in elementary subjects by examiners appointed by the Association and by the Local Boards. There are also collateral examinations in religious knowledge.

I enclose, for the information of your Royal Highness, programmes of the several examinations.

The Metropolitan Association has divided the metropolitan district into sub-districts, each sub-district having or to have its "Local Board," so that the advantages of the examinations, certificates, prizes, &c., may be brought within easy reach of the working classes everywhere in and near to London.

Boards have been already formed in the neighbourhood of some of the barracks, and a Board is to be formed immediately in this neighbourhood, near to the cavalry barracks.

It has struck me that it might be a great advantage and encouragement to the soldiers there (and in other barracks), and might tend to strengthen the excellent system of regimental and barrack instruction which your Royal Highness has already introduced, if, with the sanction in each case of the commanding officer, the soldiers, their wives, and children, not under 12 years, were invited to offer themselves for examination, and to compete for the various prizes, in common with the civilians who stand on the same social level. I do not venture, however, to say anything publicly on this subject without first understanding that it would not seem to your Royal Highness to be inexpedient that I should do so.

Finding that the "Instruction Classes" among the metropolitan police were desirous to profit by the examinations, I communicated with Sir Richard Mayne before I invited the men to present themselves.

With great respect, I submit the subject to your Royal Highness.

My wish is to be informed whether there would seem to be any objection to my stating, at the approaching public meeting for the establishment of the Local Board at Knightsbridge, that I hope the soldiers in the barracks, with their wives and children, may profit by the advantages which the Board will offer to the neighbourhood.

I have, &c., Harry Chester.

To Field Marshal H.R.H. the Duke of Cambridge, K.G.

II.

Horse Guards, March 1, 1865.

Sir,—The Field Marshal Commanding-in-Chief, having had under his consideration the proposition which you made to him on the 30th of December last, I am directed by his Royal Highness to inform you that there will be no objection to soldiers being permitted to present themselves, their wives, and children, for instruction and examination at the Educational Institutes in connexion with the Society of Arts, wherever these institutions may be established in the neighbourhood of their barracks, on the distinct understanding, however, that soldiers are not in consequence to be exempted from military duty.—I have the honour to be, Sir, your obedient servant,

Harry Chester, Esq., &c. W. F. Forster.

III.

The following circular memorandum (Gen. No. 331), addressed to the army at home, has been issued:—"Miscellaneous 1 (1865).—The Field Marshal Commanding-in-Chief desires it to be notified that there will be no objection to soldiers, their wives, and families, being permitted to present themselves for instruction and examination at the Educational Institutes in connection with the Society of Arts, on the understanding that they are not on that account to be exempted from any military duty, nor, except in special cases, to be out of barracks after watch-setting or tattoo.—By command of his Royal Highness the Field Marshal Commanding-in-Chief, James Yorke Scarlett, Adj. Gen.—Horse Guards, S.W., 11th March, 1865."

Notice to Members.

A working model of Mr. H. W. Reveley's direct-acting steam tilt-hammer, described in the current volume of the *Journal* (page 141), will be shown in action at the Society's House, on Friday, the 16th inst., at 11 a.m., when the attendance of members is invited.

Final Examinations, 1865.

The following are corrections in the list of successful candidates:—

In No. 371.—Binnie, James, omit "French (1st), with 1st Prize," he not having worked a paper in that subject.

In No. 372.—Laughland, James, after French (1st), add "with 1st prize."

Insert No. 373.—Michaelson, Maximilian, 18, Glasgow Ath., clerk—French (1st)

Proceedings of Institutions.

Haley-hill Working Men's College.—The tenth annual report, after giving a slight review of the original aims for which the college was founded, and the results which it had attained, states that during the ten years of its existence the college had fulfilled the objects of its founder. Commenced for the improvement of Haley-hill and the neighbourhood, its operations had extended to the whole of Halifax and the adjacent districts, whilst the branch at Copley had brought its advantages to the very doors of the inhabitants of that pretty village. The records of the trades and residents of the students showed that the operations of the college had been chiefly confined to the *bona-fide* working classes; and the measure of success attending the scheme was evident from the number of certificates gained in national competition from the Society of Arts, and the examinations of the Government Department of Science and Art, as well as by the valuable situations now held by many who had been under instruction in the classes. But the past had not been so satisfactory a year as several of its predecessors. The great prosperity which of late had been the portion of the working classes of Halifax and the neighbourhood had not been favourable to the success of the higher classes of the college, in consequence of so many working overtime, &c. A social economy class had been formed, both in the senior and middle divisions of the college, to which the committee attached much importance, considering it valuable in helping the students to understand many of the important questions relative to employers and workmen which were seeking solution at the present day. The young women's institute carried on its useful career in new premises. The removal of the college classes from the Haley-hill schools left those rooms at liberty, and the Principal allowed them to be appropriated to the use of the young women's classes. A second examination in scripture, domestic economy, dictation, history, geography, and arithmetic had been held, and the results, on the whole, were very satisfactory. Most of the students voluntarily took the papers, which were very creditably answered. In both of the Copley branches the work was going on well, and the comparative positions of the students of both on the class lists of the examiners showed most careful and steady working. The young men of Copley did not, however, generally take so much advantage of the opportunities for self-improvement thus offered to them as the young women. The report of the Rev. C. F. Routledge, M.A., her Majesty's inspector of schools, in reference to the Working Men's College, said—"This institution is doing its work admirably. The scholars read with great intelligence, write a neat, legible hand, and work their sums very correctly." Of the young women's institute, the inspector said—"The girls and young women have been patiently and carefully taught in all elementary knowledge, and give great promise of usefulness. The working men's college and young women's institute are doing a very great deal of good in Halifax, and are prospering very satisfactorily."

MUSICAL EDUCATION ON THE CONTINENT.

The Musical Education Committee [see page 287] have held several meetings since their appointment. One of the first steps taken by them was to request the Council to communicate with Earl Russell, Secretary of State for Foreign Affairs, with the view of obtaining, through the Foreign Office, various particulars with regard to the principal musical conservatoires on the continent, the authorities of which have, in many cases, most courteously supplied the desired information.

The Council being of opinion that abstracts of some of the documents thus received would be interesting to the members generally, have directed their publication in the *Journal*.

There are regular colleges, or, as they are termed abroad, conservatoires, for instruction in the various branches of musical art; some entirely depending for their support upon, and under the immediate control of, the Government; and others more or less independent of State support or external authority. The largest of these institutions is the Conservatoire of Paris, maintained with the utmost liberality by the Government, and under the control of the Minister of Public Instruction. And it appears to have amply repaid both the munificence and the administration provided by the Government in the excellence of its pupils and the general effect of the extension of musical taste and knowledge throughout France as an element of social progress.

The establishment of orpheonic or choral societies throughout France, equally under the control of the Government, has also greatly tended to this beneficial result.

The Conservatoire at Leipsic has attained a great celebrity by its instruction in the deeper and more fundamental science of Harmony and Composition.

Musical Education in Bavaria.

There is a Royal Conservatoire of Music at Munich, founded A.D. 1846. It receives a subvention from the Government of 7,000 florins—about £583. The students pay as follows:—Beginners pay 50 florins [about four guineas] per annum, from which there is no immunity. Students of the higher course pay 100 florins [eight guineas]. If natives, some are partly, or entirely, free from payment. The course of instruction is for three years. There are no boarders, and from eighty to ninety male and female pupils. The conservatoire is under the immediate control of the Minister of Public Instruction.

The Musical Institution at Würzburg is more for vocal instruction than the former. It receives a subsidy of 3,880 florins [about £323] from the State, and 347 florins [£29] from the Academy of Würzburg. The students are taught gratuitously; the number is about 150, including a great many amateurs.

Music is taught in all public schools of a higher class in Bavaria, and is obligatory in the seminaries for the education of teachers. In other schools musical instruction is optional, but in the middle schools, special music masters are appointed and salaried from the school funds, the pupils paying no fees for music.

The Conservatoire of Leipsic.

This institution is supported by various legacies, a small subscription from the King, and fees from the pupils. It receives no funds from the Government or municipality, and is therefore independent of state or civic control. It has rooms in the "Gewandhaus" at a nominal rent, but the repairs and alterations cost 6,000 thalers [£900]. It was opened at Easter, A.D. 1843, with 44 pupils.

The governing body consists of five directors, appointed by the King and Home Minister. The Minister of Public Instruction is *ex-officio* a director, and one director is a descendant of the founder, Herr Blumner. None of the directors are educated musicians, and the president is a retired lawyer.

The salary of the first director, Herr Schleinitz, is 1,000 thalers, £150. There are twenty teachers, who receive, on an average, £70 per annum. The teachers are engaged, some annually, and some only by the hour.

The following statement shows the funds from which the Academy is supported:—

	Thalers.	£ s.
1. The Blumner legacy, 20,000 thalers, at 4 per cent .... [The trustees appoint one director]	800 ..	120 0
2. From the King's privy purse ... [Given to six scholarships free to Saxons.]	200 ..	30 0

3. Miscellaneous legacies, 2,550 thalers, at 4 per cent.	102	..	15 6
4. The Helbig legacy, 1,000 thalers, at 4 per cent.	40	..	6 0
[This is given in premiums and musical publications as prizes]			
5. The Frege legacy, 2,000 thalers, at 4 per cent.	80	..	12 0
[Which provides half the charge for the education of two students.]			
6. The Mendelssohn legacy, 1,800 thalers, at 4 per cent.	60	..	9 0
[Given as a prize to the best pupil]			
7. 143 pupils, at 80 thalers, £12 each.	11,440	..	1,716 0
	12,722	..	£1,908 6

The complete course of Theoretical instruction is for three years. It consists of:—

Harmony, nine classes—First year, harmony and part writing; second year, harmony and counterpoint; third year, harmony, double counterpoint, and fugue.

Form and Composition, five classes. Oral instruction and exercises; vocal and instrumental composition; analysis of classical musical works.

Playing from score; conducting, with practical exercises.

Italian language for solo singers.

There are besides lectures on various musical subjects, the æsthetics of music, &c.

Singing—solo and choral—four classes.

Instrumental playing: — 1. Pianoforte; twenty classes. 2. Organ; four classes. 3. Violin and viola; solo, quartett, and orchestral; eight classes. 4. Violoncello; three classes. 5. Declamation for singers; two classes. 6. Solo playing, with accompaniment and *ensemble* playing. 7. Practice in public performance.

Instruction in the double bass and wind instruments is only given for extra fees, but it is under the control of the director. The pupils furnish their own instruments, music, and books.

Besides the above instruction, the pupils are afforded the following advantages:—They are admitted gratuitously to the rehearsals of the "Gewandhaus" concerts and to the quartette concerts, and those who are qualified play in the concerts at the gewandhaus, the oratorios, and other church performances with a large orchestra.

The musical education of France may be classified as follows:—

1.—*Superior Instruction.*—Conservatoire of Paris. Provincial Conservatoires.

2.—*Secondary Instruction.*—Lyceums and colleges.

3.—*Primary Instruction.*—Primary Normal Schools; Commercial Schools; the Orphéon Institute of Paris; courses for adults; Choral Societies and Free Orpheonic Societies.

Imperial Conservatoires for Music and Declamation in Paris.

The Director presides over the artistic branch; a Manager and Secretary assist him in the details of the general organisation. An Imperial Commissary overlooks the whole establishment, in connection with the Government.

More than six hundred out-door students attend the classes of the Conservatoire. The education is entirely gratuitous.

The attendance of pupils is registered by an Inspector of Classes.

Ten male students are admitted as boarders on the foundation; they are selected entirely from the best voices. The boarding establishment is under a superintendent. Two physicians are attached to the establishment. Ten female students are on the foundation, but board out; they only attend the singing classes.

The following is the List of Classes:—

4 Classes for Fugue, Counterpoint, and Composition.
5 Classes for Harmony.
8 Classes for Singing.
6 Classes for Single Solfeggio.
8 Classes for Single Solfeggio taught by under-masters.
3 Classes for Concerted Solfeggio.
2 Classes for Opera Instruction.
4 Classes for Comic Opera.
5 Classes for Declamation.
1 Class for Theatrical Deportment.
1 Class for Fencing.
1 Class for Popular Singing.
Evening classes for adults; chorus singing without accompaniment.
1 Class for Organ.
6 Classes for Pianoforte.
5 Classes for Clavier.
1 Class for Orchestral playing.
4 Classes for Violin.
2 Classes for Violoncello.
1 Class for Double Bass.
1 Class for Harp.
1 Class for Flute.
1 Class for Hautboy.
1 Class for Clarionet.
1 Class for Bassoon.
1 Class for French Horn.
1 Class for Trumpet.
1 Class for Trombone.
There is a branch of the Conservatoire for military students training for bandmasters in the army.
2 Classes for Harmony and Composition.
1 Class for Cornet-à-Piston.
1 Class for Sax-horn.
1 Class for Saxophone.
2 Classes for Solfeggio.

There is a committee for musical education, of fifteen members, and a committee for dramatic education, of fifteen members, the director being president of each.

A library is attached to the Conservatoire, under the superintendence of a librarian and sub-librarian. It is open daily (Sundays excepted) to the students and the public. It contains ancient and modern works, MS. and printed, and receives a copy of every new musical publication.

A museum of musical instruments, ancient and historical, under a curator, is open Sundays and Thursdays. Male and female students are instructed seperately. The professors are "titulaires and agrégés." The former receive higher salaries, the maximum being 2,500 francs. The professors for occasional instruction and for rehearsals have no salaries. All the expenses of the Conservatoire are defrayed by Government. The total expense in 1859 was 181,000 francs. Since 1859 it has not diminished. This year 20,000 francs extra will be demanded.

There are several provincial conservatories in connexion with that of Paris; at Lille, founded in 1826; at Toulouse; at Marseilles, founded in 1841; at Metz, in 1841; and at Nantes.

The Toulouse Academy is the most important. The director is appointed by the minister, has a salary of 2,000fr., and has lodgings found. The professors receive 1,400fr., and are named by the prefect on the recommendation of the Government inspector. There are two singing-classes (male and female), several solfeggio classes, two classes for pianoforte, one class for violin, one class for violoncello. It receives a subvention of 5,000fr. from Government. The town pays the rest.

The Lille Academy is chiefly for instrumental instruction. There are classes for bassoon, French horn, trumpet, flute, hautboy. It has a subscription of 4,000fr. The town supplies the rest.

The academies of Metz and Marseilles have no subvention from the state. The former is on a large scale, and has been very successful. There are other schools of music at Avignon (which costs the town 5,000fr.),

Bordeaux, Dijon, Carcassone, Montpellier, Strasbourg, Valenciennes. All these are independent of the Paris Conservatoire, have no subvention from the state, and are maintained by the municipalities or private associations. An inspector general visits the provincial academies at the expense of the Paris Conservatoire.

With regard to *Secondary* and *Primary Instruction*, a recent decree (Jan. 30, 1865) has reorganised as follows the teaching of music in the Lyceums and normal schools of the empire:—

Article I.—Instruction in music is obligatory with all pupils of the primary normal schools. Also in "plain song" for the Catholic pupils, and religious music for those of other communions.

Article II.—It embraces the following subjects:—

1. The elementary rudiments of music and singing. Reading, writing, and musical dictation.

2. The elementary principles of "plain song;" elementary instruction on the organ. The pianoforte may be employed as a substitute for the organ.

3. Elementary study of accompaniment.

These subjects are divided as follows in three years of study:—

First Year.—Elementary principles of music. Instruction in the delivery of the voice, respiration, and on the classification of voices. Lessons on the clefs of sol and fa, on the major and minor keys, and on the musical measures mostly in use. Theoretical instruction on the other clefs and measures.

Second Year.—Continuation of the exercises, writing music from dictation, execution of pieces for several voices, elementary instruction in plain song, notation, the modes, reading with words, elementary exercises on the mechanism of the pianoforte and organ, the scales in the major and minor keys.

Third Year.—Continuation of exercises in music and plain song, elementary study of accompaniment, specially with a view to the accompaniment of the plain song, reading easy pieces harmonised and the accompaniment of the plain song, the melody given either to the bass or the upper part.

Article IV.—Five hours per week are devoted to lessons in music and plain song in each of the three years. The time given in the intervals of the lessons to the study of the pianoforte and organ is taken from the hours of recreation and between the church services on Sundays.

Article V.—The organ, harmonium, and pianoforte are the only instruments employed for musical instruction in the primary normal schools.

Article VI.—Instruction in music is obligatory in the Lyceums for all the pupils of the inferior classes up to the fourth inclusive. It is optional for pupils of the third class and above.

Article VII.—The instruction is obligatory in the following subjects:—Elementary principles of music and singing, reading, writing, and musical dictation. The final object of this education should be reading in all the major and minor keys with the times most in use, and the execution of pieces of moderate difficulty for one or several voices.

Article VIII.—The optional instruction may include, besides the subjects which are obligatory, the elementary principles of harmony.

Article IX.—Instrumental music will be taught to individuals at the expense of their families.

Article X.—Two hours a week are devoted in this division to the obligatory musical instruction, Sundays and hours of recreation excepted. The pupils are taught in several courses according to their progress, and not according to the classes to which they may belong.

Orpheons of the City of Paris.

A Commission, consisting of musical notabilities, and presided over by a member of the Municipal Council, examines the questions relating to the teaching of singing in the schools of the city of Paris.

This Commission decides on the method which should be adopted by the professors, regulates the pieces of music which are to be sung by the pupils, examines the candidates for places as professors of music in the schools of the city, and gives judgments on the competitions between the professors elected.

There are 234 schools in which music is taught on both banks of the Seine. The personalty of the musical education in the schools is composed as follows:—

Two directors (one for the right bank, one for the left) each at 6,000fr. Two inspectors (one for the right bank and one for the left) at 3,600fr. Forty-four teachers and six supplementary teachers at the following salaries:—Each professor receives 200fr. for each school in which he teaches singing. A professor has the charge of a class in six schools, the ordinary salary is 1,200fr. At the end of five years the pay from each school is 233fr. 33c. At the end of ten years it rises to 266fr. 66c. At the end of fifteen years, to 300fr., which makes 1,800fr. to a professor who has six schools. When a professor has charge of several classes of adults he receives 300fr. per annum, and after five years 400fr. Each school receives three lessons of singing in the week. Twice a month the directors of the right bank and of the left bank, separately, unite the most advanced pupils of the singing classes (children and adults) on Sundays. On Thursday evenings the directors assemble the most advanced male sdults, selected by the professors, for a course of higher instruction. Every year the most advanced pupils (children and adults) sing choruses, without accompaniment, at an organised meeting. They number from 1,300 to 1,400 for each bank of the Seine. The city of Paris pays all the expenses of the "Musical Orpheon" of Paris. They amount to about 136,000fr. per annum.

Choral Societies and Free Orphéons.—The choral societies ("*Orpheons libres*") have extended throughout France a taste and a regard for music. They are not regularly organised, are upwards of 1,200 in number, and receive no subvention from the state.

Many of the societies receive from their respective municipalities a subvention for the appointment of a professor charged with the direction of the music, and rooms free of expense for practising. Other choral societies are maintained by local subscriptions and honorary non-musical members, who pay from 5 to 10 francs. Two concerts a year are given for the benefit of the honorary members. Other societies are maintained by subscriptions among the members only, which vary from 50 centimes to a franc per month.

The meetings for choral singing and the distribution of prizes attract great crowds, and for that reason are usually held in the open air. In 1862 there were 26 such meetings; in 1863, 34; and in 1864, 41.

1,040 choral societies form an effective strength of 27,500 orpheonists who have taken part this year in the choral meetings. They are frequently assisted by orchestras and bands of wind instruments.

The municipalities derive a large profit from the octroi duties paid by the large concourse of strangers attracted to the towns by the festivals. The city of Lyons received 58,002 francs 17 cents. on the occasion of the Orpheonic meeting in May, 1864. These sums are expended in the purchase of gold and silver medals, given as prizes. Gold medals for different objects are also given by the emperor, senators, deputies, and members of council of the departments.

These festivals are organised by associations of numerous choral societies. The Association of the Seine consists of 28 free Orpheon societies and 25 adherents. It has one annual concert and two meetings; it publishes a journal, and is maintained by its own resources, receiving only a small donation of 500 francs from the Minister of Fine Arts, by way of sanction.

The choral societies of Alsace include those of the

Upper and Lower Rhine. They have large meetings, and receive no subscription.

The Association of Musical Societies of Calvados has been founded only one year. It gave a concert in 1864, and is preparing another for July, 1865.

During eighteen years the choral societies of France have subscribed upwards of a million of francs to charitable institutions by giving concerts for the benefit of the poor. During the cotton crisis the choral festivals for the benefit of unemployed workmen realised 100,000 francs.

INSTRUCTION IN ART.

The following article has appeared in the *Times*:—

Perhaps the most durable and tangible result which the Great Exhibitions of 1851 and 1862 have bequeathed to us is a thorough conviction of the necessity of giving to our manufactures the extra value imparted by elegance of form and beauty of colour. Political purists may affect to doubt whether the cultivation of the taste of the nation and of its manufactures be a legitimate province for the activity of Government; but the point seems practically settled by the large sums of money which are annually voted by Parliament and by the Reports of successive Committees appointed with no friendly spirit, but uniformly ending in approving what they were appointed to condemn. We are committed, for good or for evil, to the development of our taste as a part of the duty of our Government. We have done too much to go back, and the only practical question which remains is in what direction and by what means shall we go forward.

We do not find in the debate of Thursday on the Art and Science Estimate any very practical suggestion on this point. We have established a Museum of such objects as are supposed to contribute to the improvement of Art and Manufacture, which is certainly, whatever may be its utility, one of the prettiest, best managed, and most attractive Exhibitions in London. We have founded a Central School, connected with this Museum, for the instruction of masters and of such pupils in drawing as are willing to pay the value put upon the instruction they receive, a species of oppidans or commoners, the future masters being educated at the public expense. We give besides aid, in the shape of pecuniary grants, to some ninety schools in the principal towns of the three kingdoms. Such is our present system, and we seek in vain in the rather warm debates which have been held in Parliament for any suggestion for its improvement. The great battle-field is the South Kensington Museum itself. A violent feud seems to exist on the subject. Mr. Layard maintains, apparently with good reason, that the Museum is a great boon to the metropolis; while Mr. Cox considers it too far removed from Finsbury, very convenient perhaps for the upper ten thousand, but useless to the great mass of the inhabitants he represents. Mr. Bentinck sees in this Museum one of the strongest proofs of the systematic plunder of the country for the benefit of the town, and he takes alarm at the fact that some portions of the iron building, being no longer required, are to be presented to some suburban district to form the nucleus of a new museum. This is a fair specimen of the comprehensive manner in which the support of an institution intended to exercise, and, indeed, having already exercised the most beneficial influence on our manufactures, is discussed. We cannot wonder, if there was nothing better to be said against it, that the attack on the South Kensington Museum proved utterly harmless. Mr. Potter next assailed the Training School—undoubtedly the most useful part of the expenditure for the purpose of diffusing sound art-knowledge. He considers the fees paid by unassisted students too low, and so he moved the reduction of the grant to the Schools of Art throughout the country by £1,000. This also did not appear a very satisfactory measure of reform, and so there is no reason to be surprised that the Committee did not accede to the proposition.

The weak point of the system lies, we are well convinced, neither in the Museum, which is an ornament to the metropolis, and an institution signally useful to the trade of the country, nor yet in the Training School, which has created and kept alive the highest standard of art-teaching throughout the country, and rescued many schools from ignorant and incompetent hands. The weak point of the system is in the little support that is given to Schools of Art by localities in which they are most valuable and which profit most by their services. The subscriptions raised by the richer inhabitants of the ninety places in which schools receiving aid from Government are established are absolutely contemptible. The whole amount does not, according to Mr. Potter, exceed £1,000 a year. In many places there is no subscriptions at all, and yet it is amusing to see with what pertinacity the managers of these schools, who do little or nothing for themselves, demand grants from Government, how deeply injured they feel if those grants are not as large as they expect, and how earnestly they press upon others the claims of Art to which they are almost entirely deaf. The truth is, that in Schools of Art that voluntary element which gives so much support to the schools for the education of the poor is almost entirely wanting. The Government does not in this case aid a voluntary movement, but endeavours to originate one in favour of which little or no voluntary support can be enlisted. There is very little help to be counted on from any other source than the fees paid by the working men themselves; and the existence of the system must depend upon whether these fees, together with the aid derived from Government, are sufficient to defray the requisite expenses. The Art Schools are evidently deprived of one great advantage possessed by the schools of primary education. Both classes of schools have, indeed, bodies of managers, but the managers of the schools for the education of the poor have a strong pecuniary interest in their success, and contribute as well as direct, while the managers of Art Schools are little more than recipients of public money, which they are not prepared to supplement by resources of their own. The result is that the master in the elementary poor school is the servant and under the control of the managers, while in the Art Schools the managers are little and the master almost everything.

We await with some curiosity the result of the new Minute, which seems to be the last effort that can be made on behalf of local art-education in this country. If the aid thus given be found not enough to stimulate local subscriptions, there is no remedy that we can see but to give up altogether the attempt to support local art-education at the expense of Government, and to confine ourselves for the future to increasing the Museum and maintaining the Training School, so that Art may not die out amongst us for want of skilful teachers. The rest must be left, it should seem, to the energy of the nation. If it turns out that there is not in our manufacturers sufficient public spirit to avail themselves of the assistance which the Government provides for them, it seems hardly reasonable to expect that the community at large should continue an expenditure in which those for whose profit it is designed obviously take so little interest. Nothing flourishes long in England that rests merely on Government influence. The great manufacturing community of the country have the question fully before them, and they must decide whether they will second the efforts of Government, or leave them to fall fruitless to the ground.

GRAPE CULTURE IN AMERICA.

As the London market has for some time been supplied with fresh grapes, the produce of North America, it may be interesting to members of the Society of Arts to know that more than one hundred years ago the Society was much

occupied with the question of the introduction and culture of the vine in that country. The following is an account of its endeavours at that time to promote this object:—

"Several attempts had been made, but without success, to introduce the vines of the eastern continent into our American colonies, in order to the making of wine; and the Governor of Georgia, in particular, had been fruitlessly at considerable pains and expense on this account there. The Society, however, deeming it not impracticable, and urged by the importance of the question, entered with great spirit into the design of encouraging it, and had pursued their intentions by the offer of various premiums. The first, in the year 1758, proposed the following premium for the wine itself:—'As producing wines in our American colonies will be of great advantage to those colonies, and also to this kingdom, it is proposed to give to that planter, in any of our said colonies, who shall first produce, within seven years from the date hereof, from his own plantation, five tons of white or red wine, made of grapes the produce of the colonies only, and such as, in the opinion of competent judges, appointed by the Society in London, shall be deemed deserving the reward, not less than one ton thereof to be imported at London, one hundred pounds.' This premium was continued to be advertised up to 1765, the period appointed for the bringing in the claims, and then dropped. After the year 1759, a *nota bene* was added to the advertisement, which expressed 'that the method of cultivating vines for wines, and the manner of making wines in different countries, were to be found in Miller's Dictionary, edit. 1758.' During the time this premium was offered, others for the raising vines for wines were also proposed to be given. In 1762 the following advertisement was published:—'A premium of two hundred pounds will be given for the greatest number—not less than five hundred—of the plants of the vines which produce those sorts of wines now consumed in Great Britain, which shall have been properly planted and effectually fenced, secured, and cultivated within any of the British colonies upon the continent of North America to the northward of the river Delaware, considered as one district, between the 1st of 1762 and the 1st of April, 1767; and fifty pounds for the next greatest quantity, not less than one hundred plants.'

"The like premiums were separately offered 'for any of the British colonies on the continent of North America to the southward of the river Delaware.' And the same was also proposed 'to the Bermuda Islands.' To these advertisements was subjoined a *nota bene*, declaring that 'the person who should be entitled to the premium for making five tons of wine, as published in the list of premiums, in 1761, should not be entitled to these premiums.' In 1763 the Society thought proper to continue the premium for the planting vines in the colonies to the southward of the river Delaware, and the Bermuda Islands, to the year 1768. In 1765 they also proposed to give additional premiums of two hundred pounds, and fifty pounds, under the like limitations, for the planting the same quantity of vines, actually producing the grapes, which yield those sorts of wines now consumed in Great Britain, between the 1st of April, 1768, and 1st March, 1770. These premiums have not been extended since the time mentioned, because the introduction of vines into America was known to have taken place. The first account of the success of these premiums was in 1763, when Mr. Carter sent a dozen bottles of two kinds of wine from grapes which grew in vineyards of his own planting in Virginia. The one of these kinds was the product of vines brought from Europe, the other of the American wild vines. They were both approved as good wines; and the Society gave their gold medal to Mr. Carter as the first who had made a spirited attempt towards the accomplishment of their views respecting wine in America. In 1767 there were claims made for the premiums on the planting vines, both from the districts to the southward and northward of the river Delaware. But the form of certification of that to the southward not being conformable to the advertisement, the claim was not allowed. There were two claims for that of the northward; but the claimant who had planted the greatest number of vines having also failed in some essential points of certification, the premium was adjudged to the other. However, in consideration of having planted so great a number of vines as two thousand one hundred, the Society thought fit to give him a gold medal.

"When the cultivation of the vine was first attempted, the vintage was found in many parts to be subject to very frequent miscarriages from the bursting of the grapes, caused by the rains, before they were ripe. But the Society's measures had occasioned trials of the native vines of America, which were before only considered as wild, useless plants, that promised much better success. In 1768 the Society offered medals for the cultivation of the indigenous native vines.

"The following additional awards, for the planting and culture of the vine, were made:—In 1768, £200 was awarded to Edward Antill, Esq., of Brunswick, North America, for vines planted for making wine; in 1769, the Society's gold medal was awarded to the Earl of Sterling, New Jersey, North America, for planting 2,100 sets for wine; in 1771, £50 to Mr. Christopher Sherb, of Carolina, for planting and cultivating a number of vines in South Carolina, and producing wines made of them; in 1772, the Society's gold medal to Mr. Du Menil de St. Pierre, of Charlestown, for planting and cultivating the vines and indigo, and producing silk by foreign Protestant labourers in the interior part of South Carolina.

"The production of raisins in our American colonies was another of the early objects of the Society. In the year 1759 the following premium was instituted:—'To the person, in any of our American colonies, who shall first raise and cure, from his own plantation, and import into the port of London within six years from the 25th of March, 1759, five hundred pounds weight of good raisins, fifty pounds.' There never was any claim made for this premium; nor, as appears, any effort to obtain it. This mode of premium appearing thus not effectual for the purpose, the Society, in the year 1762, changed it to the cultivation of the vines which produced raisins; and advertised as follows:—'A premium of three hundred pounds will be given to the person who shall, on the 1st of September, 1767, have, or be possessed of a vineyard, or plantation, in any of the colonies upon the continent of North America, southward of the river Delaware, consisting of the greatest number of vines—not less than fifty—actually producing the true Malaga grape, from which the best raisins are made. And one hundred pounds for a like plantation, or vineyard, consisting of not less than twenty-five plants, producing the said grapes.' The next year the Society advertised that they proposed to continue these premiums to the year 1770. These premiums do not appear to have had more effect than those for the raisins themselves."

ROYAL SCOTTISH SOCIETY OF ARTS.

At the meeting, on Monday evening, the 10th of April, Charles Cowan, Esq., President, in the chair, a paper, communicated by Mr. ROBERT AYTOUN, F.R.S.S.A., "On an Improved Plan of Drawing Coals, whereby great Speed is attained with a small Expenditure of Power," was read.

The author stated that the weight of the rope used in drawing coals absorbs a great part of the power employed. In deep pits, for every ton of coals drawn, there may be from two to three tons of rope drawn also. The author's improvement consists in hanging another rope, of the same weight and length as the one previously employed, by its two ends, to the under sides of the two cages, and passing it under a pulley at the bottom of the pit, to keep it in its place. By this expedient the rope is perfectly balanced

in every position, one half ascending while the other half is descending, and the engine is absolutely relieved from the burden of the rope, at the mere expense of the friction caused by the weight of the additional rope, which is trifling. Pits, whose depth requires stronger and heavier ropes than could be worked on the present unbalanced system, may be worked (in the author's opinion) on the proposed system successfully, and with engines of moderate power; for the entire weight of the ascending rope and cage is balanced by that of the descending ones, and the engine has nothing to do but raise the coals and overcome the friction caused by the weight of the ropes, cages, and coals. The author showed the simplification which this system permits of being introduced into the winding apparatus. Instead of the lofty pit-head frame, and its two pulleys, he places a single large pulley over the mouth of the pit, corresponding to one at the bottom. The drawing rope is to be passed over this pulley, and the cages are to be hung to its two ends. This rope, connected to the lower rope by means of the two cages, may be considered as an endless band stretched between the two pulleys, and completely balanced in every possible position. The steam-engine, by means of a connecting rod working a crank on the shaft of the upper pulley, sets it in motion either way; and the pulley, by means of the friction betwixt its surface and the rope, communicates that motion to the rope and the cages with their loads.

The paper describes its application to a pit 300 fathoms deep, in which two tons of coal are drawn at a time. It is there pointed out that the winding friction is the only unproductive work, and amounts to no more than three per cent.; while 97 per cent. of the power derived from the steam-engine is productively employed. The paper next shows how it may be applied to drain, by means of tubs, the "drowned out" mines of Tyneside, yielding 5,000 gallons per minute. The unproductive power in this case, it is stated, would only amount to two per cent.

Besides these advantages, there are said to be others which result from the engine being connected with the drawing rope by the friction of the pulley, instead of by solid shafts or toothed wheels. If the engine is forced into violent action, which would endanger the rope on the old plan, it will merely cause the pulley to slip under the rope. If the cage should meet with an obstacle in the shaft, the rope again slips on the pulley and no damage is done. But the chief advantage occurs when the engine does not stop when the cage has reached the top of the pit. The result would be, under the present system, the dangerous accident of over-winding; but, in the proposed system, as soon as the lower cage rests upon the bottom, and the rope and upper pulley are relieved of its weight, the friction is reduced *pro tanto*, and the pulley slips under the rope, without having power to raise the cage above the landing, and no damage whatever is done to the winding gear, or to the individuals who may be in the cage.

As the slipping of the rope on the pulley prevents breakage in the shaft, a much higher speed than is considered safe at present can (says the author) be maintained. As there can be no over-winding, this higher speed may be maintained till the cage has almost reached the surface. This is a saving of time. Again the engine stops, with the steam nearly full on, balancing the loaded cage; thus there is no occasion for struts for the cage to rest upon, and the time wasted on them is also saved.

This system is supposed to be peculiarly adapted to the use of safety cages. There is a screw which moves the lower pulley, and tightens the rope, thereby compressing the springs of safety cages and keeping the clutches, or claws, clear of the guide rods. This removes the only objection which is now urged against the use of safety cages, as it permits them to have powerful springs to overhaul the broken rope, without there being any danger of their catching the guide rods while the rope is entire.

Fine Arts.

Lost Picture Found.—M. Triccia, of Florence, a painter and restorer of pictures, has made a fortunate discovery. He was engaged by an amateur to examine a collection of miscellaneous matter, when he discovered a large canvas, eight feet long and more than six feet high, which struck him immediately as a work of importance, and he succeeded, after some trouble, in deciphering the name of the painter, "Luca Signorelli." Such a work is specially mentioned by Vasari, who says that Signorelli visited Florence to study the great masters of that school, and painted for Lorenzo de Medici a picture called "The Naked Gods," which had a very high reputation. Vasari adds, "we have no information whatever about the fate of this picture." M. Triccia declares that there is no doubt that the work which he found neglected in a loft is that to which the critic refers.

New Gallery Opened in the Louvre.—The directors of the Louvre have just opened another series of rooms containing pictures of the French school; amongst which will be found works by Fouquet, De Courmon, Ambroise Dubois, Jean Cousin, and others of the Burgundian school; an excellent collection by Clouet, and other artists of the fourteenth, fifteenth, and sixteenth centuries; and a large number by Lesueur, Lahire, Simon Vouet, Bon Boulogne, Restout, Jean Mosnier, Charles Lafosse, Joseph Vernet, Hubert-Robert, Casanova, and others. The new gallery has been called after Eustache Lesueur.

The Bonaparte Monument in Corsica.—On the 15th ult., Prince Napoleon presided over the inauguration of the grand monument raised at Ajaccio to the memory of Napoleon Bonaparte and his family. The Emperor is on horseback surrounded by his four brothers, and all, by a strange caprice, very unusual in France, are dressed in Roman costume. The equestrian statue is nearly ten feet high, and the others about seven feet each; the base is raised more than twelve feet above the level of the soil. The statues are cast with bronze furnished from cannon taken in the late Italian campaign, but two winged Victories, placed in the basement, are of marble. The entire monument is about a hundred feet in length and twenty-five feet in height. The general arrangements were entrusted to M. Viollet le Duc, and the sculpture by MM. Barye, sen., Thomas, Jean Petit, Maillet, and Dubray. The day of the inuaguration was a grand fête. The population of Ajaccio is only 14,000, but 40,000 people were collected on the occasion. Prince Napoleon delivered an eloquent address, which occupied an hour and a half.

Exhibition of Retrospective Art.—The Paris Union Centrale des Beaux-Arts as applied to industry, whose establishment in the Place Royale has been noticed in the *Journal*, has decided that the Exhibition of Industrial Art which is to open under its auspices in the Palais de l'Industrie on the 10th of August, shall include retrospective art as well as that of the present day; and has just issued an invitation to collectors for contributions. The Council expresses its conviction that such a collection will be of great service, at the time when all the world is preparing for the Universal Exhibition of 1867. The retrospective exhibition is to include objects of all past epochs without exception, antique, mediæval, and renaissance.

Art Patronage in Mexico.—The Emperor Maximilian has always been a patron of art; when Archduke, the Saxon sculptor Knaur executed busts of Goethe, Schiller, Shakespeare, Dante, and Homer, for the chateau of Miramar. The Emperor has just commanded of the same artist busts in Carrara marble of Alexander the Great, Julius Cæsar, Augustus, Antoninus Pius, Marcus Aurelius, Charlemagne, Charles Quint, Napoleon I., Napoleon III., and Humboldt, for the Imperial Palace of Mexico.

A Born Artist.—M. Charles Ooms has just received the first prize of excellence in painting at the Royal Academy at Antwerp. Seven years ago he was engaged in minding his mother's cows, in a village in the Campine, but instead of leaving the animals to the best pasturage, he occupied himself in making innumerable sketches of them. His mother complained of the boy's idleness to her daughter, who was in service in Antwerp, and the latter, in her turn, spoke to her master on the subject. This caused an inquiry to be made into the matter, and the sketches were thought sufficiently promising to warrant the education of the lad, who was utterly without any kind of instruction. M. Teichman, the Governor of Antwerp, and his secretary, M. Thielens, recommended the boy to M. de Neyser, the director of the academy in that town, who received and protected him, with the result already mentioned.

Manufactures.

New Iron Bridge.—There has been just completed, in the yard of the Regent's Canal Ironworks Company, a remarkable iron bridge, which is the largest yet constructed on a system invented by Mr. A. Sedley. The structure in question has been made to the order of the Indian Government, and is designed to be erected in India. The leading feature of the new principle is that, without the necessity of any subaqueous works, or the erection of any intermediate towers or piers, the bridge can be built to cross in a single span any river or chasm up to an extreme width of 500 yards, or 1,500 feet. The bridge just finished is of 75 feet span and 14 feet wide; its total weight is 22 tons, including the roadway, and it will support a nominal strain of four tons per sectional inch, but really a greater weight. Two great cantilevers, or wedge-shaped girders, are built up piece by piece till they are projected from opposite sides of the chasm or river which is to be bridged over, and extended till they approach within a distance something less than a third of the whole span. Across this space a central girder is thrown, which, while it completes the continuity of the bridge, acts, when fixed in position and riveted down, as the key-stone, so to speak. The wedge-shaped girders which project from either side of the stream are at their wide ends embedded and built into massive piers of masonry on the shores. The base of the wedge is fixed by iron tugs, in an upright position; the central arm of the girder supports the actual roadway of the bridge; the lower arm, stretching to the point of the girder, becomes a bracket support; and the upper arm passing over the summit of the upright end, which makes the thick end of the wedge, is extended backwards as a tension bar, and anchored firmly in the earth, thus giving suspensory support to the central arm, which attains a perfect rigidity. Upon the piers the whole strain is thrown. The roadway is constructed of the iron-buckled plates, invented by Mr. Mallet, which have done such good service on Westminster-bridge. For the hill-roads in India the bridges constructed on Mr. Sedley's new system seem well adapted.

Commerce.

The Whitehall and Waterloo Pneumatic Railway.—It appears that arrangements have now been made which will admit of the commencement of the works of this proposed railway immediately on the necessary Parliamentary powers being obtained. The Bill has passed the Commons, it is now unopposed in the Lords, and in a few days it may be expected to receive the Royal assent. The proposed line will commence at an open station to be formed in Great Scotland-yard, and be continued in brickwork under the Thames Embankment to the river; across which it will be carried in a watertight iron tube, encased in cement concrete, laid and fixed in a channel dredged out of the bed of the river. From the river the line will be continued in brickwork under College-street and Vine-street, to a station convenient for the traffic of the York-road and the Waterloo terminus of the South Western Railway. The steepest gradient will be 1 in 30. The trains will be worked to and fro by pressure and exhaustion alternately, and at intervals of from three to four minutes from each end; a frequency of despatch hitherto unattempted. The carriages will be as commodious, as well lighted, and as completely fitted for the comfort of the passenger, as those of the Metropolitan Railway. The iron tube will be made by Messrs. Samuda, and the laying of the tube and the other works will be undertaken by Messrs. Brassey and Co. The principle upon which the line will be worked will be the same as that adopted on the experimental railway in the grounds of the Crystal Palace. The machinery will be on the Surrey side, at the York-road station. The whole of the works are to be completed in twelve months from the date of the commencement. The cost of the undertaking will be about £130,000. The pneumatic system, by which air is applied to railway propulsion and the incumbrance of the locomotive is got rid of, differs materially from the former atmospheric system. Under the new system, the train is wholly within a tube or covered way (through which it is rapidly propelled by the pressure of the air behind it), so that not only are all the difficulties attending the continuous valve and the consequent leakage avoided, but the advantage of working with greatly reduced pressures, and with proportionate economy, is obtained. Thus, while the old system necessitated a pressure of from 120 ounces to 160 ounces per square inch to move the train—under the new, a pressure of 3 ounces or 4 ounces per square inch is found sufficient. Indeed, in its present form the pneumatic system is simply an adaptation of the process of sailing to railways; the wind being produced by steam-power, and confined within the limits of a tube.

Tunny Fish.—This fish, which, when pickled, is much esteemed in France as a *hors d'œuvre* or relish, is generally rather scarce, but recently an enormous quantity were taken in the waters of a little fishing village called Sausset, between Port de Bouc and Marseilles, and accounts from the last named place say that the number brought to market there has been about fifteen hundred a day, and that the quantity remaining still in the *madrague*, or great net used for catching this fish at Sausset, is so great that it is feared a large portion will be lost for want of means of preserving the fish quickly enough. The single haul at which all these fish were taken is believed to have yielded about 40,000 francs (£1,600) to the society of fishermen at Sausset, and that after a certain amount is withdrawn, according to established custom, for the reserved funds of the society, each fisherman will have about £24 for his share of the proceeds.

Colonies.

Telegraphs in New South Wales.—The telegraph line between Braidwood and Araluen has been completed, and opened for messages. The only extension at present in progress is that from Queanbeyan to Cooma, of which a length of about fourteen miles is finished. A contract has been taken for the formation of a telegraph line from Deniliquin to the borders of South Australia, to afford direct communication between Sydney and Adelaide, but the work has not yet been commenced. No new lines are proposed in the estimates for the present year. Applications have been made to the Government for the extension of the telegraph to various districts; but as all the more important towns in the colony are now con

nected by the wire with Sydney, it is made a condition of further extensions that residents in the districts desiring the telegraph should guarantee to the Government a return of five per cent. upon the outlay for five years.

New South Wales Coal. — The quantity of coal entered at the Sydney Customs, from 17th February to 20th March, 1865, inclusive, was 13,218 tons, while the shipment from the various mines on the Hunter, Newcastle, for the same period, amounted to 16,875 tons.

The Revenue of Tasmania appears to be not very flourishing. The total received from all sources for the past year was £181,074, as against £183,455 in 1863. In the Custom-house the decline was £2,809.

Sirocco and Bush Fires in Victoria.—On 27th February a fierce sirocco wind set in from the north-west, exceeding in its velocity and overpowering heat any that has been experienced for the last fourteen years. It was felt in a nearly equal degree all over the country. Extensive bush fires speedily commenced, and in Melbourne the heavy smoke filled the city like a thick fog; breathing became difficult, and except in houses whose inhabitants had closed every window and door betimes, a sense of prostration prevailed. At Ballarat the heat reached 99 degrees, and bush fires raged from Spring Hill and Learmouth to the border of Bullarook Forest. From Geelong to Ballarat was nearly a line of fire, and much damage was done to houses, crops, and fences. In the country round Daylesford similar disasters occurred. The large agricultural district of Kyneton was severely visited, and a long list is recorded of homesteads, growing crops, stacks, well filled barns, and fencing destroyed by the calamitous fire. Steps have been taken for the relief of the sufferers. Parliament has been asked for £50,000 to help the more completely destitute, and the colony is being canvassed for subscriptions in aid of the Kyneton farmers, of whom many are completely ruined.

Wine-making in South Australia.—The past season has been very dry for the grapes, and will affect the weight of the yield; but, with careful management, a very superior wine may be produced. The wine-growing interest is now assuming a really important character from the number of persons engaged in this industry, and from the large and increasing capital at stake. Considerable excitement prevails amongst vignerons in consequence of the late colonial government having intimated their willingness to allow free distillation from the produce of the vine at least. Should the present restrictions upon converting wine into spirits be removed, a great impulse would be given to the vineyards of this colony.

Publications Issued.

A Record of the Progress of Modern Engineering, 1864, comprising civil, mechanical, marine, hydraulic, railway, bridge, and other engineering works, with essays and reviews. By W. Humber, Assoc. Inst. C.E., and M. Inst. M.E. (*Lockwood and Co.*) This volume contains detailed drawings to a large scale of many important works, among which will be found the following:—The entrance to the Mersey Docks, Birkenhead, including the low-water basin, details of the sluices and flushing apparatus, the hydraulic machinery for working the shuttles, also the hydraulic machinery for opening and closing the lock gates; the bridge over the fifty feet lock, with the hydraulic machinery for moving the same; the pumping engines, engine house, and accumulators; also the landing stage in the low-water basin, &c. The Charing-cross Railway Station, with full detailed drawings of the roof; viaducts and bridges on the Great Northern Railway; College-wood Viaduct on the Cornwall Railway; the principal details of the Winter Palace at Dublin; the railway-bridge over the Thames at Blackfriars; full details of the Greenock-docks; viaducts on the Merthyr, Tredegar, and Abergavenny Railway; and other engineering works. The letter-press comprises articles on the formation of harbours and breakwaters, with a description of the works at Greenock; a full description of the arrangement of the Birkenhead Docks and hydraulic machinery; articles on iron permanent way, &c., &c.

Notes.

Exhibition of Insects.—A novel kind of exhibition is announced to take place in the Palais de l'Industrie of Paris, in August and September. The Central Society of Agriculture has conceived the idea of showing to the public a collection of insects useful for their productions—such as silk-worms of all kinds, bees; insects producing colouring matter; edible insects; and insects made use of in medicine; and, secondly, of such as are mischievous to various crops—as cereals, the vine, citrons, and other plants made use of in industry, green crops, and other edible plants, fruit trees, forest trees, timber and wood; and, lastly, of parasitic insects of all kinds. The edible insects will include the eggs of the Hemiptera of Mexico, with the bread made from the same; the larvæ of India and China; locusts; and Polynesian spiders. The Acclimatisation Society and the model farms maintained by the Imperial Government will furnish a considerable number of living specimens in some of the divisions; but there is little doubt that in others the public must be content with the "still-life." The Minister of Agriculture and of Public Works has accepted the presidency of the Committee of Organisation, which includes several persons of scientific eminence. The Exhibition is announced to open on the fifteenth of August.

Literary and Artistic Convention between France and Bavaria.—International property in works of art and intellect is rapidly extending, and cannot fail to exercise considerable influence, not only on artists but on the general condition of education and taste. By the convention concluded in March last, but just now promulgated, the artists and authors of each country will enjoy in the other the same privileges and protection as if they had been first published in that country, and all works of the kind referred to will be allowed to pass duty-free between the two states on the production of certificates of their origin. The convention comes into operation on the first day of July in the present year, and is applicable to any of the states of the Zollverein that may desire to subscribe it.

The Eruption of Etna.—The eruption of great volcanos is an object of such terrible magnificence, that few observers are sufficiently masters of their judgment to form any very correct notions of the various circumstances of the phenomena. In the present instance, however, M. Fouqué, a French *savant*, has studied this convulsion of nature for fifteen days under great difficulties and privations, and has communicated the results of his observations to his friend, M. Sainte Claire-Deville, who has published them to the world. The eruption commenced on the last night in January, two shocks of earthquake having occurred during the previous day. At the moment of the breaking out of the convulsion there was another and very violent shock, which was, however, only felt on the north-east side of the mountain. At Lavina, near Piedimonte, the inhabitants were so terrified that they fled from their houses and spent the night in terror in the open air, while at Catania, on the other side of Etna, the earthquake was scarcely felt. The eruption commenced on the north-east side, at about 1,800 yards above the level of the sea, and 500 yards from an old crater, Monte Frumento, which is itself at the base of the principal volcano. As soon as the earth was opened, the lava began to pour forth, and in four days the stream was nearly four miles long, full half that in breadth, and in

many places not less than from thirty to sixty feet in depth. The river of fire flowed down a part of the mountain, having an average inclination of four or five degrees, destroying everything in its course, till it encountered another old cone known as Monte Stornello. Here the lava was divided into two streams, one descending gently on the west of Stornello, while the other precipitated itself into a deep and narrow valley, situated between Monte Stornello and the chain of hills called Serra de la Boffa. Here a cascade of fire, bearing on its surface masses of solidified blocks, fell over a precipice more than 150 feet deep with fearful noise; the valley was soon completely filled, and the stream of lava continued its course for nearly two miles more, and stopped on the place of an old lava flood called the Sciarra de la Scorcia Vacca, at an altitude of about 2,600 feet above the sea. The western stream continued its course, and became itself divided into two; one of these continued progressing till the 21st, and the other till the 25th of February, when the head of each was arrested, but small lateral streams continued to be produced at intervals. On the 6th of March another stream burst forth from the west of the craters, and was still increasing and advancing rapidly when M. Fouqué wrote. This will give some idea of the enormous power and extent of these hidden fires, which in a few days can fill up valleys and change the face of a country for miles. But M. Fouqué's account of the craters themselves extends the idea of the terrible grandeur of such convulsions. The craters, he says, are seven in number; five of them lie in a large elliptical space, each crater being not at the top but at the side of a cone or hill, from 150 to 200 feet high. The other two craters are on the outer side of one of these cones. The ellipse containing the five craters is described as forming as it were one great crater, the ground being burst open and split in all directions. This great oval crater, which is closed in on all sides but one, whence escapes the river of lava already mentioned, is about 1,300 feet long, and 100 feet wide at its narrowest part. From the base of the Monte Frumento to that of the nearest crater exists a tremendous fissure, about 1,800 feet in length, generally thirty feet wide, and in some places of immense depth. This huge crack is partly filled with blocks of chilled lava, the effect of the snow, which had accumulated to a considerable depth. Where the lava stream was most dense the heat was so great that the largest pines were entirely carbonized, even at a distance of sixty feet from the fiery river. This account enables us to form some slight idea of the convulsions which subterraneous fire has created at various times on the surface of our globe.

Gigantic Asparagus.—Enormous heads of asparagus have recently appeared in the Paris market, and many guesses have been made respecting the mode of their production. It is said that a large grower was recommended to cultivate the plants not together, as in the ordinary manner, but dispersed amongst other vegetables in his garden, and that the success was beyond all his expectations. The cause of this is not evident, but it may be suggested that probably the experiments were tried in a very warm soil in the south of France, which supplies Paris with an enormous quantity of fruit, peas, and asparagus. Having succeeded in obtaining a gigantic growth, the grower tried a further experiment. He placed over each shoot, as soon as it appeared above ground, a glass bottle, or rather short tube with a bottom to it, pressing the latter down as far as possible into the ground. The consequence of this treatment is the production of enormous heads, each sufficient to make a dish of itself, and in some instances weighing nearly a pound. This colossal asparagus is said to be equal in flavour and as tender as the finest known kinds produced in the ordinary manner.

Locomotives on Common Roads.—Some time since, an experiment was tried at Nantes, which was recorded in the *Journal*, with the view to the establishment of steam omnibuses on the ordinary road. The first essays were made with an experimental machine, but recently the first trial of a new one was made in the presence of the Maire and some of the principal people of the place, who filled the omnibus attached to the locomotive. The engine, of eight-horse power, weighs seven tons with its coal and water; it is more than eighteen feet long and nearly six feet wide outside the wheels. The journey was performed without interruption, with the exception that in one place too short a turn was taken and the locomotive had to be unhooked from the omnibus before the error could be rectified. The 29 kilomètres between Nantes and Nort were performed in two hours, the locomotive stopping twice to take in water. The steam omnibus was to ply regularly after that day between the two towns.

Home for Apprentices.—Mr. Hartley, of the Westminster Marble Works in Earl-street, London, has founded a home for boys, who are taken as apprentices, and placed in a small house, in which a person resides connected with the works, who acts as a master; his wife is the superintending matron; and the control of these lads is placed in their hands. They are called in the morning to go to their work; they return at stated times to their meals, which are always ready for them. There is thus no time lost. After the work is over there are books and newspapers for them to read, or occupation is found in writing and drawing. They are allowed full liberty of ingress and egress, being fined, however, if not in by a stated time, which varies according to the season, and they are allowed a small sum a week for pocket-money; they are thus placed in a position which must have a very material effect in qualifying them to fulfil their duties properly when arrived at manhood. The boys are taken at about thirteen or fourteen years old, and retained until twenty-one, at which age they ought to be able to take care of themselves, and make room for others; and during this period they have all the advantages of a home, and at the same time a surveillance is exercised over them which others in the same station of life have not at their own paternal homes. This institution is said to have been found exceedingly advantageous, not only as an industrial school, but to the master who has founded it, for on a comparison made by Mr. Hartley of the loss sustained by him during a year, taking twelve boys of the Home and twelve apprentices living at their own homes, he found that the loss by absence amounted in the whole to but 11s. 3d. from the college boys; whereas, from the apprentices living with their parents, the loss on the same account exceeded £40 during the same period. Mr. Hartley's proposal is to establish similar institutions throughout the country. There appears to be little or no expense attending them, such as is usually the case with Reformatory Institutions. A small house, at a low rental, capable of containing about fifteen lads, is amply large enough. In fact they might be self-supporting; for employers would be willing generally to pay for the board of their apprentices, rather than receive them into their own houses—this being the great objection to taking them at all.

Correspondence.

On the Wear and Tear of Steam-boilers.—Sir,—As Mr. Paget has omitted (in his last letter) to identify the supposed equivalent passages of his double-barrelled letter, I fancy (but I may be wrong) that my priority is established, as I expected it would be, in the publication of the leading causes of the furrowing and pitting of steam-boilers, which form the basis of his paper. About the stay-bolts, mentioned incidentally by myself, it seems as if he has just succeeded in tracing a prior publication by Mr. Colburn, which certainly presses rather closely upon me. But, if he knew of this before, why did he not acknowledge it in his paper? And if he did not know of it, why did he not acknowledge my publication? It is very likely Mr. Colburn sent me the paper referred to,

just as Mr. Paget sent me a copy of his paper on boilers; but I don't read all that I get in this way. You know the old proverb :—" Though you may take a horse to the water, you cannot make him drink." But, on Mr. Paget's own principles, he must have read what I have written and quoted in your columns for his edification, though he did omit to acknowledge it.—I am, &c., D. K. Clark.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...R. Geographical, 8½. 1. Colonel L. Pelly, "Journey to the Wahabee Capital, interior of Arabia." 2. Capt. Allen Young, "On the Korea."
British Architects, 8.
Tues. ...Medical and Chirurgical, 8½.
Zoological, 8½.
Syro-Egyptian, 7½.
Photographic, 8.
Ethnological. 1. " Dr. S. Nilsson, "An Attempt to explain Stonehenge." 2. Dr. Shortt, "An Account of a Religious Festival, comprising Leaf-wearing and the Hanging or Cheddul."
Wed ...Society of Arts. Annual Conference, 12. Conversazione, 8½.
Microscopical, 8.
Literary Fund, 3.
Archæological, 8½.
Thurs...Royal, 8½.
Antiquaries, 8.
Linnæan, 8. 1. Mr. Bates, "On New *Phasmidæ*." 2. Dr. Dickie, "On Arctic *Algæ*." 3. Prof. Oliver, "On Two New Genera of African *Anonaceæ*."
Chemical, 8. Messrs. Frankland and Duppa, "On the Lactic and Acrylic Series of Acids."
Numismatic, 7. Annual Meeting.
Philosophical Club, 6.
Fri.......Philological, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 23rd May, 1865.*

154. Bills—Inclosure (No. 2).
161. ,, Coroners (Ireland).
267. Gunpowder—Reports by Lieutenant-Colonel Boxer, R.A.
290. Metropolis Turnpike Roads—Thirty-ninth Report of the Commissioners
295. Leeds Bankruptcy Court—Official Letters, &c.
Turkey and Persia—Correspondence.

Delivered on 25th May, 1865.

157. Bills—Procurators (Scotland) (as amended in Committee).
158. ,, Trusts administration (Scotland) (as amended in Committee).
160. ,, Malt Duty.
162. ,, Metropolitan Houseless Poor—Lords Amendment.
163. ,' Drainage and Improvement of Lands (Ireland) (Provisional Orders Confirmation) (No. 2).
259. Greenwich Observatory—Correspondence.
275. Copper, &c.—Return.
276. Mail Contracts (India, Ceylon, &c)—Returns.
279. Armstrong Guns—Report of Admiral Kuper.
286. Taxes (Great Britain and Ireland)—Return.
289. Military Savings Banks—Account.
294. Mr. Edmunds' Resignation—Lords Report.
296. National Education (Ireland)—Return.
301. Curragh of Kildare—Correspondence.
China and Japan—Order in Council.
National Education (Ireland)—Thirty-first Report of Commissioners.
Public General Acts—Cap. 17 to 25.

Patents.

From Commissioners of Patents Journal, June 2nd.

Grants of Provisional Protection.

Animal charcoal, revivification of—1336—G. H. Ogston.
Animal charcoal—1409—R. Muller, A. T. Weld, and J. F. Powell.
Bedsteads—1379—C. Copus.
Bottles, flasks, stoppers, &c.—1320—S. T. Garrett.
Bottles, securing corks or stoppers in—1373—R. A. Brooman.
Calico printing—1420—J. Dale and A. Paraf.
Cannon, rifling muzzle-loading—1332—W. Spence.
Coal gas, purifying—1386—W. Davey.
Cotton presses—1423—G. Ashcroft.
Cotton-spinning—1383—T. Marsden.
Dish-covers, &c., wire gauze—1401—D. Powis and H. Brittain.
Distilling apparatus—1393—J. A. Coffey.
Dust, apparatus for collecting—909—E. Leak.
Electricity, production and application of—1412—H. Wilde.
Envelopes—1416—H. Gibbs.
Fabrics, brocaded and ornamental, weaving—1312—D. Ellis and M. Hillas.
Fabrics, woven—1316—T. Smith and H. James.
Fire-arms, breech-loading, and cartridges—1308—J. R. Cooper.
Fire-arms, breech-loading—1382—S. Ebrall.
Gas-burners and chimneys—1334—W. Clark.
Gas meters—1395—W. Smith and G. Brown.
Goat's hair, application of in imitation of human hair—1367—H. Rushton.
Hats, fur or felt, machine for fulling—1314—E. L. Girard.
Horse-shoes—1025—W. Clark.
Hydraulic cranes—1421—H. A. Bonneville.
Iron girders, casting—1304—J. Goodwin.
Knitting machines—1397—E. Attenborough, S. Mellor, and G. Blackburn.
Land-cultivation, machinery for—1104—D. Greig.
Letter-clips—1354—H. E. Dixon.
Locks—1406—W. Hodson.
Locomotive engines—1358—W. Montgomerie.
Looms—1417—T. Calvert and D. Montgomery.
Mangles—1418—H. Nunn.
Manumotive carriages—1388—G. Read.
Manure, liquid, apparatus for distributing—1369—C. S. Phillips.
Nitrogen and sulphur, obtaining compounds of—1385—T. Richardson and M. D. Rucker.
Oil, &c., raising from deep wells—1392—W. E. Newton.
Ovens for bread-baking—1346—J. Dauglish.
Paper-hangings—1399—J. Wylie and J. Rew.
Photographing on wood, &c.—1174—W. H. Smith.
Pile-driving machinery—1378—W. Eassie.
Piles, machinery for cutting off the upper parts of—1408—G. Furness and J. Slater.
Ploughs—1326—J. Eddy.
Printing machines—1344—R. and H. Harrild.
Railways, communication between passengers and guard on—1322—W. Chubb and S. Fry.
Railways, securing rails on permanent way—1306—W. Tijou.
Refrigerators—1405—J. H. Johnson.
Saw-mills—1340—G. Ennis.
Screws and screw-drivers—1387—A. V. Newton.
Screw-cutting apparatus—1411—E. McNally.
Sewing machines—1337—J. Laing.
Sewing machines—1384—H. de Mornay.
Sewing-machines—1407—J. M. Clements.
Stays, corsets, &c., fastening supports of—1338—R. Langridge.
Steam-cranes—1342—C. J. Appleby.
Time-pieces and clocks—1415—H. Adler.
Water-gauges and cocks—1330—A. Weir.
Weaving, power looms for—1307—W. Jamieson.
Yarn, machine for tying hanks of, previous to dyeing—1248—F. Caldwell.
Yarns, dyeing and sizing—1413—I., W., and J. Holt, and J. Maude.

Invention with Complete Specification Filed.

Cartridges, loading—1463—G. G. Bussey.

Patents Sealed.

3020. J. G. Winter.
3022. R. Tye.
3027. J. Yearsley & E. Timbrell.
3039. J. Keeling.
3045. E. T. Hughes.
3046. R. Richardson.
3048. C. A. Martius.
3051. A. Albert.
3053. M. J. Roberts.
3057. C. Oliver.
3060. C. Crockford.
3065. W. Tongue.
3066. T. H. Roberts.
3069. A. J. Sedley.
3220. H. Johnson.
3230. G. Edwards.
197. J. B. Wood.

From Commissioners of Patents Journal, June 6th.

Patents Sealed.

3055. J. Livesey and J. Edwards.
3062. R. A. Brooman.
3070. L. Morgenthau.
3071. J. Vaughan.
3072. G. Rooper.
3075. E. Brooke.
3078. R. Mathers.
3083. C. Kendall.
3099. G. W. Belding and G. M. Holman.
3100. J. G. Tongue.
3169. M. Henry.
3188. G. Haseltine.
3191. J. Paterson.
3197. E. Saunders.
3202. E. Leahy.
3243. E. Shufflebotham.
3254. W. E. Newton.
1. W. Muir.
37. J. C. Amos and W. Anderson.
95. R. Chidley.
596. W. R. Bowditch.
725. H. Owen.
786. J. H. Johnson.
822. J. Tall.
856. J. Todd.
936. J. H. Johnson.
981. J. H. Johnson.
1128. J. Emary.

Patents on which the Stamp Duty of £50 has been Paid.

1637. A. Gilbey.
1663. J. Whitworth.
1684. G. B. Toselli.
1857. E. C. Nicholson.
1699. P. M. Parsons.
1674. S. Weston.
1677. A. H. Perry.
1702. G. Hadfield.
1721. F. Giachosa.
1745. J. Hetherington.
1678. G. Peel and J. Simpson.
1703. W. E. Newton.
1707. W. R. Jeune.

Patents on which the Stamp Duty of £100 has been Paid.

1219. J. Young and J. Strang.
1239. C. Wheatstone.
1239. C. Wheatstone.
1298. D. Moseley.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, JUNE 16, 1865. [No. 656. VOL. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Musical Education Committee.

This Committee are now meeting once or oftener in the week. They have taken evidence from Sir George Clerk, Bart., Mr. H. F. Chorley, Mr. Otto Goldschmidt, and Mr. Lucas, the Principal of the Royal Academy of Music, which will be published in the *Journal*.

Final Examinations, 1865.

The following alterations and additions should be made in the list of successful candidates:—

Omit 875—Ashmore, Isaac, 18, St. Thomas's Young Men's Christian Inst., pupil teacher.

After 869—Bradbury, Edwin, omit Arith. (3d), he not having worked a paper in that subject.

For 1338—Fielding, John, 17, Bradford M.I., clerk, Arith (2d), read 1337, Alfred Goulton Hooper, 18, Bradford M.I., banker's clerk—Arith. (2d)

Proceedings of the Society.

Conversazione.

A Conversazione took place at the South Kensington Museum on Wednesday evening, the 14th inst., when about 3,700 members of the Society and their friends were present. The company was received on entering by Mr. William Hawes, Chairman of the Council. The bands of the Royal Artillery and of the Coldstream Guards were in attendance, and performed selections of music during the evening.

The exhibitions of Portrait Miniatures, and of the Raphael Cartoons were open, and excited considerable interest.

Fourteenth Annual Conference.

The Fourteenth Annual Conference of the Representatives of the Institutions in Union, and the Local Educational Boards, with the Council of the Society, was held at the Society's House on Wednesday, the 14th inst, at 12 o'clock, noon. WILLIAM HAWES, Esq., F.G.S., Chairman of the Council, presided.

The following is a list of the Institutions and Local Educational Boards represented at the Conference, with the names of their respective representatives:—

Aldershot and Farnham Board of Education	Mr. Barrow Rule.
Alton Mechanics' Institution......	Mr. William Curtis, President.
Ashford Mechanics' Institution...	Mr. Henry Whitfeld, President.
Banbridge (Ireland) Mutual Improvement Society..............	Mr. J. Baxter.
Banbury Mechanics' Institute ...	Mr. R. Heygate Brooks, Hon. Sec.
Berkhamstead Mechanics' Institution	Rev. J. Hutchinson, President.
Blackburn Literary, Scientific, and Mechanics' Institution ...	Mr. R. H. Hutchinson. Mr. W. E. Smith.
Bradford Mechanics' Institute ...	Mr. J. G. Best.
Bury Athenæum	Rev. C. F. Hildyard, President. Mr. J. M. Wike, Vice-President.
Carlisle Mechanics' Institution...	Mr. W. Lawson, M.P. Mr. E. Potter, M.P.
Chatham, &c., Mechanics' Institution	Mr. H. G. Adams. Mr. H. P. Mann.
Christchurch Mechanics' Institution	Mr. Joseph Clark, R.A. Rev. Z. Nash.
Faversham Institute	Mr. F. W. Monk. Mr. J. A. Anderson.
Gilford (Ireland) Young Men's Mutual Improvement Society.	Mr. W. R. Masaroon.
Glasgow Institution	Mr. Alexander Craig.
Hastings Mechanics' Institute ...	Mr. C. J. Womersley. Mr. Joshua Huggett.
Hertford Local Board	Mr. J. S. Foster, Secretary.
Hitchin Mechanics' Institution...	Mr. Joseph Pollard.
Huddersfield Mechanics' Institution	Mr. Hiley. Mr. Stavenhagen.

Hyde Mechanics' Institution ...	Mr. Thomas Ashton, President.
Kent Association of Institutes ...	Mr. W. G. Adams. Mr. F. W. Monk.
Lancashire and Cheshire Union of Institutes	Mr. Councillor Rumney. Dr. R. M. Pankhurst. Mr. Thomas Lawton.
Lichfield Free Library and Museum	Captain Dyott, Chairman.
Llanelly Mechanics' Institution	Mr. W. H. Nevill, President. Mr. R. T. Howell, Vice-President. Mr. L. D. Bevan.
London, Bank of England Library and Literary Association	Mr. John Coe.
,, City of London College	Rev. R. Whittington. Mr. F. Reynolds.
,, Greville House, Paddington	Mr. Bright. Mr. Faulkner.
,, Mechanics' Institution	Mr. T. J. Pearsall. Mr. S. Vallentine.
,, ,, Local Board	Mr. T. A. Reed.
,, Metropolitan Association	Mr. E. Hay Currie, Hon. Sec. Mr. H. H. Sales.
,, St. George's and St. James's Westminster Local Board	Rev. G. B. Macilwain.
,, St. Margaret's and St. John's (Westminster) Local Board	Rev. W. S. Bruce. Mr. J. A. Gosset.
,, Walworth Literary and Scientific Institution	Mr. J. S. Noldwritt.
Oldham Lyceum	Mr. J. T. Hibbert, M.P. Mr. John Platt.
Peterborough Mechanics' Institution	Mr. J. F. Bentley, President.
South Staffordshire Association...	Mr. John Jones.
Smethwick, Messrs. Chances' Library	Mr. F. Talbot.
Yorkshire Union	Mr. Barnett Blake.

The Secretary read the following

Report to the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Gentlemen,—In reporting to you the Proceedings of the Society in connection with the Union of Institutions for the past year, I have the pleasure to record that Walter Slater, of the London Mechanics' Institution, one of the successful candidates of last year, has, after a competitive examination before the Civil Service Commissioners, obtained an assistant clerkship in the Privy Council Office, the nomination being placed at the disposal of the Council by Earl Granville, one of the Vice-Presidents, who has thus evinced the continued interest which he takes in promoting the success of the Society's proceedings. Year by year it has been my duty to record an increase in the work of the Union, and this year forms no exception; indeed, there has been a larger increase in the numbers examined at the Final Examination than in former years. The number of candidates examined this year, is 1,199, being an increase of 131 over 1,068 examined last year, while the increase of last year over the previous one was only 112.

The number of local centres at which the Examinations have been held is 100, where the Local Boards have conducted the Society's Final Examination of the 1,199 candidates who worked papers this year. The number of papers worked has been 1,744, as compared with 1,540 last year, showing an increase of 204; and the Society's examiners have on these papers awarded 1,351 certificates, viz., 315 first-class, 519 second-class, and 517 third-class, leaving 393 to which the examiners have not thought it right to award any certificates.

The corresponding result of last year's Examination gives the total certificates awarded as 1,222, divided into first-class, 236; second-class, 479; third-class, 507, with 318 papers to which no certificates were given.

Included in the above total of candidates for the present year were 35 female candidates, of whom 26 obtained certificates.

The detailed results of the Examinations, of which the above is a summary, are given in Table II., page 511, which shows the manner in which the different subjects have been selected by the candidates.

The Prince Consort's Prize of 25 guineas, graciously continued by Her Majesty the Queen, has been won this year by Thomas Healey, of the Burnley Mechanics' Institution, a book-keeper, who in the present year and during the three preceding years has obtained the greatest number of first-class certificates, viz.:—

1862. Arithmetic—First-class Certificate.
,, English History—First-class Certificate, with Second Prize.
1863. Book-keeping—First-class Certificate.
1864. Algebra—First-class Certificate, with First Prize.
,, Mensuration—First-class Certificate, with Second Prize.
,, Chemistry—First-class Certificate, with Second Prize.
1865. Music—First class Certificate, with First Prize.
,, Animal Physiology—First-class Certificate, with First Prize.

The number of prizes awarded this year has been 51, as compared with 55 last year, and the money amounts in the two years (1864 and 1865) are respectively £217 5s. and £211 5s. This is exclusive of the Royal Horticultural Society's prize of £5 which has been awarded. In reference to prizes, I must not omit to mention that one only of the five prizes offered by the Royal Horticultural Society, for the encouragement of gardeners to make themselves acquainted with the scientific and botanical principles in which their practice should be founded, has been taken. A few competitors only appeared, but it must be borne in mind that these prizes were offered after the Society's Programme for the year had been published, and

	Number of Centres.	HIGHER GRADE. Male Candidates. Exa-mined.	Passed.	Female Candidates. Exa-mined.	Passed.	LOWER GRADE. Male Candidates. Exa-mined.	Passed.	Female Candidates. Exa-mined.	Passed.
Aldershot and Farnham District	1	4	3	1	1	7	6	..	..
Burnley [East Lancashire Union]	4	13	13	..	..	..	..	..	..
Christchurch	1	10	10	..	..	4	4	..	..
Derby	1	1	1	..	..	..	..	..	..
Edinburgh [Philosophical Institution]	1	6	6	1	1	..	..	..	..
Hastings and St. Leonard's	1	3	2	..	..	..	..	..	..
Hertford	4	1	1	1	1	14	8	..	..
Kent Association of Institutes	3	13	11	..	..	29	16	4	4
Lancashire and Cheshire Union	39	220	46	..	..	410	113	50	15
Liverpool College	1	..	..	..	..	5	4	..	..
*London [Metropolitan Association]	16	88	20	42	7	368	127	86	35
South Staffordshire Association	12	43	29	..	..	74	38	5	5
Whitby	1	3	3	..	..	..	..	..	..
Worcestershire Union	7	23	11	..	..	36	8	..	..
York Institute	1	4	3	..	..	..	..	..	..
Yorkshire Union	22	107	38	10	2	289	179	69	38
Totals	115	539	197	55	12	1,236	503	214	97

* These Examinations were held at a later date, on papers of a similar character, prepared by the Examiners of the Association.

thus but short and insufficient notice could be given.

In the Appendix to this report will be found the remarks of the examiners on the character of the present year's Examinations. The Tables show the occupations, actual or intended, of the various candidates in respect of whom returns were received as intending to be examined, some of whom, however, were unable to fulfil their intentions, leaving the number actually examined 1,198, as before stated. This year there has been in operation the system which was set on foot last year, of appointing visiting officers in each Union, to represent the Society, and to assist in organising the classes for adult teaching, and give aid in the formation of Local Boards, and information with respect to the Examinations. Thus visiting officers have been appointed for five Unions, as follows :—

Lancashire and Cheshire Union,	Mr. Thomas Lawton.
Metropolitan Association	Mr. H. H. Sales.
South Stafford Association......	Mr. John Jones.
Worcestershire Union	Mr. F. Marcus.
Yorkshire Union	Mr. Barnett Blake.

The system, however, has been too short a time in operation to show any decided results in reference to the Examinations, though, without doubt, the labours of these gentlemen have tended to increase very materially the efficiency of the Institutions as educational establishments.

It will be remembered that in my last Report I mentioned the appointment by the Council of an Education Committee of the Society, which should include representatives from the various district unions, and whose duty it should be to advise the Council with reference to the preparation of the Programme of Examinations, both elementary and final, and also to supervise the preparation of the papers for the elementary examinations, a work formerly performed by a body known as the Central Committee, with which the Society was only indirectly connected.

This modification in the arrangements, which, as I explained last year, was made principally with the view of avoiding the confusion that inevitably resulted from the anomalous position of the Society in the Central Committee, is believed to have worked satisfactorily. The number of candidates has considerably increased, although the Southern Counties Adult Education Society, which adopted this system last year, has this year not done so ; moreover the number of centres of examination has been larger, showing that the interest in examinations of this character has been spread over a wider area.

Last year these examinations were held by 10 district unions or boards, at 104 centres ; this year 16 district unions or boards have held them at 115 centres. In 1864 there were 1,795 candidates, of whom 877 obtained certificates. Of these, 435 were higher grade candidates, of whom 170 obtained certificates ; 1,360 lower grade, of whom 707 obtained certificates ; this year the whole number of candidates examined was 2,044, of whom 809 obtained certificates, the proportions being 594 higher grade, with 209 successful ; and 1,450 lower grade, with 600 successful. The tabular statement shows that among the higher grade candidates were 55 females, 12 only obtaining certificates ; and

among the lower grade were 214 females, with 97 successful.

It will be readily understood that these numbers, large as they are, most inadequately represent the amount of encouragement really afforded to the progress of Elementary Education by the various Local Boards and Institutions connected with the Society. A considerable number of them prefer adopting a scheme of elementary examinations of their own. Happily there are many highly-educated men on these boards who are perfectly capable of setting papers in such subjects as are usually included in the term elementary education, or of examining their candidates *vivâ voce;* and the reports of many of the Institutions show that periodical local examinations in those subjects which may be said to form the basis of all education are held in many localities with the best results.

In order to afford you more detailed information as to the state of many of the Institutions, I cannot do better than quote from the reports of our visiting officers:—

Mr. Barnett Blake reports as follows:—

There has been a continued favourable progress of the Mechanics' Institutes of Yorkshire, notwithstanding the occasional instances of depression, and a few cases of failure from exceptional causes. In the important feature of number of members, there are forty-two Institutes in which there has been a decrease of 823 members in the aggregate, but this is more than compensated by fifty-five other Institutes, showing an increase to the extent of 1,281 members. Of the larger Institutes, Leeds, Bradford, Halifax, Huddersfield, Wakefield, Darlington, Dewsbury, West Hartlepool, Scarborough, Bingley, and Keighley, show an increase considerably exceeding the slight diminution of numbers in a few others. It is, however, still more satisfactory to notice the much greater improvement in the number of class-pupils, which in fifty-nine Institutes amounts to above 18 per cent. over last year. Much of this improvement may fairly be attributed to the examinations of the Society of Arts which have been materially promoted by the Elementary Examinations. The advantages have been brought more prominently before the members of the smaller Institutes; success has been more apparently within reach, and consequently more highly appreciated, and in several instances it has led to the candidates who were induced to submit to the lower ordeal being encouraged to try for the higher certificates. Nor is the beneficial influence limited to that which appears in the number of successful candidates. At the presentation of Elementary Certificates and Prizes great interest is excited, and a stimulus given to many others to strive by mental application to achieve similar honours. I have been present on such occasions at Eston Mines, Hebden Bridge, Hunslet, Leeds, Ossett, Scarborough, Slaidburn, Stockton, and Thirsk, where the most lively interest was manifested, and further encouragement given by the offer of local prizes in addition to those given by the West Riding Educational Board. The Elementary Examinations have been held this year at twenty-one places in the Yorkshire Union where Local Boards were established for the purpose, and as seven of them were for the first time it is hoped that as every year they become better known the system will be still further extended. Of 117 candidates in the higher grade only forty were successful. Of the whole number 76 passed in Arithmetic, but 22 failed from insufficient number of marks, and 10 failed in two additional subjects. Of 358 candidates in the lower grade there were 217 successful. Of the whole number 297 passed in arithmetic, and of these 19 failed from insufficient number of marks, and 50 failed in two additional subjects. As the greater number of the candidates are employed during the day, and have only the evening classes of the Institute by which the imperfect education of the day-school can be carried out, there is great difficulty in instructing them in history and geography sufficiently for the requirements of the Elementary Examinations. It is therefore by many considered desirable that, in the lower grade at least, it should be necessary only for the candidate to pass in one subject besides reading and arithmetic. There is, however, no doubt that the system is effecting much practical good by promoting a sound basis of instruction, and in many instances preparing candidates for the more advanced Examinations of the Society of Arts. The success of the system of Elementary Examinations must be still more evident when taking into account the large number of candidates, and bearing in mind that, with few exceptions, the larger Institutes of Yorkshire have not yet adopted it. Another good effect is the encouragement of the practice of plain needlework by young women of the working population, which is apparent not only in the increasing number of female candidates, but also in the increase of female members of Institutes, which amounts to nearly sixteen per cent. in 71 Institutes in the Yorkshire Union. This is an encouraging sign of progress, and the more valuable as it is the training of the wives of working men and the mothers of our future population. Some difficulty is experienced in carrying on the work of adult education, owing, in a few instances, to the want of competent teachers, but more often to the inefficiency of accommodation for classes. This, however, is endeavoured to be obviated by the erection of buildings, and several Institutes are now making exertions to raise funds for the purpose. At Bingley, and at Cottingley, a neighbouring village, very excellent buildings have lately been completed; whilst at Addingham, Almondbury, Calverley, Cleckheaton, Hartlepool, Leeds, Lockwood, Rothwell, Saltaire, and Shipley, funds are being raised with a fair prospect of success. In the reading-rooms of Institutes there is an increase in the number of newspapers and monthly publications, with a very slight falling-off in the number of weekly and quarterly publications, so that this department of the Institute is well maintained. In the libraries of 97 Institutes there has been an addition during the year of more than seven thousand volumes, which shows an increasing desire for literary pursuits, and is so far encouraging. Upon the whole, therefore, after making allowance for the few instances of failure, and the fluctuations to which a busy people are always liable, there is much reason to be satisfied with the condition and prospects of the Institutes of Yorkshire, and as the practical stimulus which is given to mental cultivation by the Society of Arts in its Annual Examinations becomes year by year better known, there is fair ground to expect a still increasing spread of education, and its accompanying blessings in a more civilised and moral population.

In reference to the Institutions in the Metropolitan District, Mr. Sales writes as follows:—

"The principal feature in the work of the Society of Arts, connected with Metropolitan Institutions during the past year, has been the establishment of evening classes on the basis of the City of London College and London Mechanics' Institution. These classes are held in school-rooms, as the Bromley Evening Classes; or, as in the case of the West London Youths' Institute, form part of an Institution. In either case the general principle is the same, viz., independent class instruction under duly qualified teachers. The extension of this system will produce an annual increase of candidates in the Society's examinations. In the institutions in the district, little direct educational work is carried on; but I believe that this is

owing to the prevalent system of establishing classes without regard to the requirements of the members, and placing them in the hands of unpaid teachers. The working-classes who frequent these Institutions are willing to pay for the instruction they require, but are keen enough, on the one hand to know what subjects are necessary for their individual advancement, and on the other to discern the failings of the system of voluntary tuition. As the evening class scheme becomes more generally adopted, greater progress will distinguish the operations of the Mechanics' Institutions, Mutual Improvement Societies, or by what other name they may be called. In addition to the reading-room, most Institutions include in their programme lectures, discussions, and choral societies, at which the attendance is generally satisfactory. At Greville-house Library and Reading-room a brass band has been organised, and is very popular among the members. Only one Working Men's Club is in union with the Society in London, but having, by request, attended many meetings of clubs, and explained the operations of the Society, I hope that during the ensuing autumn classes may be established in many clubs. In the Duck-lane Club, Westminster, a sound educational work is being carried on. Established for the lowest classes of the population, and frequented by them, it is not to be supposed that the attainments of the members are sufficient to bring them within the scope of the Final Examinations, nevertheless the instruction given produces perceptible and gratifying results."

Mr. Marcus, of the Worcestershire Union, reports—

That the Union at the present time embraces 28 Institutions and Twelve Night Schools. The members of the Institutes in Union and the attendants at the Night Schools have largely increased in numbers, and the schools are much better taught and managed. The results of the Elementary and other Examinations are also of a highly encouraging character, the numbers being largely in excess of previous years. In the Elementary Examinations by the Society of Arts there were for the Higher Grade 23 candidates, of whom 11 passed; for the Lower, 36 candidates, of whom 8 passed. This Union offers special encouragement to the candidate for these examinations by awarding three prizes (£2, £1 10s., and £1) to the best in the Higher Grade, and four prizes of 10s. each to the best in the Lower Grade. For the Final Examination of the Society of Arts there have been 19 candidates from the following Institutions:—Redditch Literary, Kidderminster Mechanics', Worcester Catholic, and Bromsgrove Literary. These numbers would have been largely increased were it not that several of the Institutes in Union, being also in alliance with the Staffordshire Adult Education Society, have elected to be examined under that Board. In addition to the Society of Arts' Examinations, the Worcestershire Union has had special examinations, and awarded prizes of its own.

Mr. Jones, of the South Staffordshire Association, says:—

The area covered by this Association has to a considerable extent been seriously unsettled during the past year by a succession of labour disputes, which have injuriously affected the position of many of the leading institutions of the district. At the same time several societies have extended their operations. The Willenhall Literary Institution have completed a new and commodious building, and have largely increased their member list. The class-work connected with the Institutes in Union has been, in the majority of instances, interrupted by the cause above mentioned. The Wolverhampton Working Men's College—a society which for seven years has successfully conducted a large number of classes—has not this season been so well attended, and is about to be suspended. On the other hand, the number of evening schools has this season increased. I should here explain that the institutions in this district do not as a rule take up instruction in elementary subjects, as is the case in Lancashire and Yorkshire; this part of the work of adult education is carried on by evening schools. The Dudley Mechanics' Institute alone has an evening school as a part of its organisation, and it has this season been even more successful than in any former year. The number of Institutions in union with the Association is nearly thirty, but of these only a small proportion are connected with the Society of Arts. Several large institutions, lying just on the confines of the district, have applied for visits from me, and I have been able to stimulate them to prepare candidates for the Society of Arts Examination. On the whole I may say that, notwithstanding the temporary depression before mentioned, there has been much work done during the season, and there is every prospect that another winter will be much more satisfactory than the last.

Mr. Lawton, of the Lancashire and Cheshire Union, reports—

The working and progress of the Union of Lancashire and Cheshire Institutes during the past year will, to a considerable extent, be seen by reference to the following statistics:—

	Month ending May, 1864.	Month ending May 1865.
Number of Institutes in Union	80	118
Number of subscribers to the Union	41	113
Institutes in Union with the Society of Arts	19	29
Institutes with Day Schools under Government Inspection	9 per cent.	18 pr. ct.
Institutes with Day Schools not under Government Inspection	8 per cent.	13 pr. ct.
Institutes with Government Science Classes	18	23
Institutes employing paid teachers	45	63
Institutes with complete arrangements for preparing pupils for the Elementary Examinations	30	51
Number of Elementary Certificates awarded	69	172
Institutes with successful candidates at the Elementary Examinations	11	45

It may be observed that the principal objects contemplated by the Union are—(1) The establishment of suitable class operations. (2) The employment of properly qualified teachers. (3) The distribution of the Institutes into groups, with a view (*a*) of facilitating the working of the examination scheme and (*b*) of conducting classes for special subjects at the Central Institute on behalf of the district. (4) The awarding of supplementary prizes (*a*) by the Union and (*b*) by the several districts to the most successful candidates at the Examinations.

APPENDIX.

EXAMINERS' REMARKS.

The Examiners in the respective subjects make the following observations on the work done in this year's Final Examinations:—

Arithmetic.—As a whole, the papers this year are hardly equal to those of last year in power and accuracy. The writing out is clear and legible, and the figures are round and well formed.

Book keeping by Double Entry.—The average knowledge of the subject and expertness in work exhibited by the exercises in this department, as compared with those of former examinations, are well maintained, and I am well satisfied with the quality of the work generally. Some few papers are distinguished by great intelligence

TABLE I.—Results of the Examination of 1865.

NAME OF LOCAL BOARD.	No. of Candidates Examined at Previous Examination by Local Board.	No. of Candidates who Passed Previous Examination by Local Board.	No. of Candidates Examined at Final Examination.	No. of Candidates who Passed at Final Examination.	No. of Papers Worked at Final Examination.	No. of First-class Certificates awarded.	No. of Second-class Certificates awarded.	No. of Third-class Certificates awarded.	No. of Prizes awarded to Candidates.	No. of Unsuccessful Candidates.
Aberdeen	21	16	18	16	19	1	9	7	1	2
Accrington	*	*	3	3	3	...	1	2	...	...
Acomb	1	1	2	2	4	...	1	3	...	...
Aldershot and Farnham	9	9	8	8	17	3	6	7	...	...
Alton (Southern Co. Adult Ed. Assoc.) ...	*	*	1	1	1	...	1	...	...	...
Ashford	6	4	3	2	3	1	1	...	...	1
Bacup	4	4	16	8	30	1	5	7	...	8
Banbridge (Ireland)	*	*	3	3	7	2	...	4	...	...
Banbury	7	5	7	7	12	6	5	1	2	...
Belfast	3	3	6	5	15	3	5	5	...	1
Birmingham and Midland Inst.	18	17	19	16	24	1	5	12	...	3
Blackburn...	11	6	6	3	7	...	2	2	...	3
Blandford...	4	4	3	3	7	...	5	2	...	...
Bolton	*	40	22	13	31	1	3	11	...	9
Bradford	20	16	19	19	40	8	17	13	2	...
Bristol	48	43	31	26	43	8	13	12	2	5
Burnley (East Lancashire Union) ...	55	14	35	31	69	5	16	24	3	4
Bury (Lancashire)	12	6	6	2	7	...	2	5	...	4
Calverley	*	*	2	2	6	1	2	3	...	...
Carlisle M.I.	4	4	5	4	6	2	...	3	...	1
Chatham, Rochester, Strood, and Brompton.	4	4	6	6	16	3	4	7	1	...
Chelmsford	3	3	3	3	5	...	2	3	...	...
Christchurch (Hants)...	10	10	11	6	17	...	2	5	...	5
Clitheroe	7	4	4	4	8	...	...	6	...	...
Crewe	11	11	11	9	24	1	4	7	...	2
Dean Mills	2	2	2	2	2	...	1	1	...	...
Deptford...	8	7	7	6	10	...	3	4	...	1
Derby	1	1	1	1	3	2	1	...	...	...
Devonport	24	21	34	32	72	13	28	23	2	2
Edinburgh (Lit. and Phil. Inst.) ...	5	5	7	7	9	1	5	3	...	...
Farsley	2	2	1	1	1	...	..	1	...	...
Faversham	*	*	8	7	15	1	4	6	...	1
Gilford (Ireland)	6	5	8	8	10	2	4	2	1	...
Glasgow (Athenæum)	26	26	25	25	33	17	7	6	4	...
,, (Institution)	32	25	21	15	24	1	11	4	...	6
,, (Mechanics' Institution... ..	95	91	70	58	79	12	26	27	...	12
,, (Popular Evening Classes Andersonian University ...	20	16	23	22	28	8	10	8	4	1
Halifax (Mech. Inst.)	8	8	7	7	8	2	3	2	...	...
,, (Working Men's College) ...	25	20	27	26	31	9	18	3	...	1
Haslingden	4	4	10	3	13	1	1	1	...	7
Hastings and St. Leonard's	3	2	2	2	4	...	2	2	...	...
Haughton Dale	3	1	4	4	9	1	1	6	...	...
Hertford	4	4	5	5	9	3	4	2	..	...
Hitchin	1	1	4	3	5	1	1	1	...	1
Hull	11	10	11	10	17	2	4	9	1	1
Hunslet	*	*	1	1	2	...	1	1	...	...
Ipswich	22	20	17	16	24	5	9	7	...	1
Leeds (West Riding Educational Board, Yorkshire Union)	*	22	28	22	42	5	12	12	2	6
,, Young Men's Christian Association ...	4	4	6	5	7	2	1	2	..	1
Leicester	4	4	5	5	6	3	2	1	1	...
Lichfield	8	7	7	7	9	3	4	2	...	...
Liverpool College	5	4	3	3	6	...	1	5	...	...
London (City of London Coll.)	78	74	102	89	139	51	36	33	16	13
,, (Royal Polytech. Inst.) ...	23	22	24	19	28	6	11	4	2	5
London Metropolitan Assoc. (Hackney) ...	*	*	2	2	5	2	1	2	...	...
,, (Lambeth) ...	*	*	7	4	9	...	2	4	...	3
,, (London M.I.) ...	8	6	12	12	19	5	8	4	1	...
,, (Pimlico)	*	*	1	1	2	...	1	...	...	...
,, (St. Stephen's, Westm.)	12	8	8	6	14	3	3	4	1	2
,, (Stepney Deanery) ...	12	12	8	7	10	4	2	3	...	1
Louth	4	4	5	4	5	2	1	1	...	1
Macclesfield	16	9	8	4	12	...	...	4	...	4
Manchester (Lancashire and Cheshire Union)	13	8	15	13	26	2	6	12	...	2
Manchester Mechanics Inst.	63	46	57	50	79	21	26	16	...	7
Middlesbro'	6	4	10	8	11	3	4	2	...	2
Mossley	18	13	17	15	22	4	8	5	...	2
Newcastle-on-Tyne Church of Eng. Inst. ...	*	*	2	2	2	...	...	2	...	...
,, Mechanics' Inst. ...	2	2	9	8	14	1	6	5	...	1
Oldham (Lyceum)	28	18	22	18	29	5	10	6	1	4
,, (Science School)	29	29	35	22	36	6	8	8	...	13
Paisley (Artizan's Inst.)	27	25	28	24	30	2	12	12	...	4
Pembroke Dock	10	10	11	11	21	7	7	6	...	...
Peterborough	2	2	1	1	1	1	...	...	...	...
Rawtenstall	*	*	7	3	10	1	...	2	...	4
Reeth	10	*	2	2	7	...	...	2	...	...
Salford	31	31	44	35	63	15	20	16	2	9
Scarborough	*	4	5	4	17	2	1	7	...	1
Selby	*	*	1	1	2	...	1	...	...	..
Slaidburn	*	*	1	1	4	...	...	4	...	...

* Returns none, or incomplete.

TABLE I.—(CONTINUED.)

NAME OF LOCAL BOARD.	No. of Candidates Examined at Previous Examination by Local Board.	No. of Candidates who Passed Previous Examination by Local Board.	No. of Candidates Examined at Final Examination.	No. of Candidates who passed at Final Examination.	No. of Papers worked at Final Examination.	No. of First-class Certificates awarded.	No. of Second-class Certificates awarded.	No. of Third-class Certificates awarded.	No. of Prizes awarded to Candidates.	No. of Unsuccessful Candidates.
Slough	2	1	13	11	16	5	4	4	2	2
Southampton	23	21	21	17	30	5	12	6	...	4
South Staffordshire Union (10 centres) ...	45	42	65	54	89	14	29	27	...	11
Staleybridge	3	2	2	1	2	...	...	1	...	1
Wakefield	5	5	7	7	13	2	7	4	...	...
Whitby	3	3	3	3	7	1	3	3	...	...
Wilsden	5	4	2	2	6	...	1	4	...	...
Woolwich (Royal Arsenal)	39	39	28	14	30	1	7	6	...	14
Worcestershire Union (3 centres) ...	33	12	12	6	20	2	3	6	..	6
York	4	3	8	6	15	3	5	2	...	2
Totals..........................	1,135	992	1,199	999	1,744	315	519	517	51	200

In addition to the above List of Prizes is the Horticultural Society's Prize of £5, which was awarded to a Candidate in Botany, examined at the Slough Local Board, being the only one obtaining a Certificate in that subject who is a gardener by profession.

TABLE II.—NUMBER OF PAPERS WORKED IN EACH SUBJECT IN THE FOUR LAST YEARS; WITH THE RESULT FOR THE YEAR 1865.

SUBJECTS.	1862.	1863.	1864.	1865.				
				No. of Papers Worked.	No. of First-class Certificates.	No. of Second-class Certificates.	No. of Third-class Certificates.	No. of Papers in respect of which no Certificate was awarded.
Arithmetic	336	358	431	446	79	109	175	83
Book-keeping	169	182	210	275	115	142	15	3
Algebra	96	81	93	68	8	22	19	19
Geometry	26	40	35	26	1	2	16	7
Mensuration	44	42	50	43	..	7	20	16
Trigonometry	11	12	13	10	..	3	1	6
Conic Sections	2	2	1	1	..	..	1	..
Navigation, &c.	1	3	4	4	2	..	1	1
Principles of Mechanics	16	11	8	11	1	2	6	2
Practical Mechanics	15	17	14	15	..	..	7	8
Magnetism, Electricity, &c. ..	8	21	22	19	2	3	5	9
Light and Heat	..	..	..	7	3	3	1	..
Astronomy	5	3	4	1	..	..	1	..
Chemistry	37	81	99	107	10	33	30	34
Animal Physiology	40	16	42	84	4	12	18	50
Botany	9	3	8	12	1	2	2	7
Agriculture	1	1	4	..	..	..	..	..
Mining and Metallurgy	17	16	11	6	..	4	1	1
Political and Social Economy ..	6	7	1	5	..	2	2	1
Domestic Economy	8	11	10	13	4	5	2	2
Geography	69	58	88	87	17	26	27	17
English History	80	71	89	94	9	34	37	14
English Literature	21	23	26	30	11	11	5	3
Logic and Mental Science	18	18	9	15	4	7	4	..
Latin and Roman History	20	16	21	9	2	3	3	1
French	80	88	77	99	4	19	51	25
German	17	18	26	19	4	10	5	..
Italian	..	..	..	4	3	..	1	..
Spanish	..	..	..	10	3	1	4	2
Freehand Drawing	28	74	50	56	1	11	21	23
Geometrical Drawing	14	55	66	128	21	29	26	52
Music	23	32	28	40	6	17	10	7
Totals	1,217	1,360	1,540	1,744	315	519	517	393

and accuracy. The number of candidates continues to increase.

Algebra.—Whilst there have been several failures—rather more than one-fourth of the total number of candidates having fallen through—a good deal of talent and acquaintance with the subject has been evinced by a fair portion of those who have passed. Every question has met with a solution among the papers sent in, which is a favourable symptom, as one or two of them are of a kind to call forth the exercise of original thought. Altogether I regard the result of the examination as of an encouraging nature. In many instances the literary style of answering is good. In other cases, however, a more diligent study of the English language might be recommended with advantage to some of the candidates. The word "ternary" appears to have been a stumbling-block to some, it having been variously interpreted as referring to the numbers 2, 5, and 7.

Geometry.—The general character of the papers is good. Several candidates have evinced aptitude in solving problems. Many have shown that they appreciate closeness of logical sequence, and none failed to exhibit some benefit gained by their study of the subject.

Mensuration.—It may be observed that none of the candidates are in the first class, and that there are too many in and below the third. This I attribute to the want of due attention to the elements of the subject. In the arithmetical part their work is satisfactory, but in the geometrical part it is not.

Trigonometry.—The answers to the questions were very well worked out, and although none of the candidates obtained sufficient marks to be placed in the first class, those who have second-class certificates did not fail for want of ability. All the important and more difficult questions were answered by one or other of the candidates.

Conic Sections.—Only one candidate has answered the questions in the Conic Sections and Algebraical Geometry paper. Although the answers are not as good as heretofore, yet the subject deserves encouragement, for the disciplinary value of it is very great, and I cannot recommend the Council to discontinue it.

Navigation and Nautical Astronomy.—The number of candidates in this subject is still very small. There is an improvement in the style of working the problems, and two first-class certificates have been awarded.

Astronomy.—It is strange that a single candidate only furnished any answers to the several questions. Year by year I have been urging increased attention to those parts of mathematics on which astronomy rests, and upon their practical application. In previous years I have totally failed in obtaining one satisfactory answer to any question on either the theory or the practice of interpolations. Last year a very satisfactory advance was shown in the application of spherical trigonometry, and in the practical reduction of observations as far as required. This year this is almost totally wanting, and the questions answered or attempted to be answered, were those rather upon the literature of astronomy than upon astronomy either theoretical or practical. I am disappointed. It is clear that the paper set, although by no means difficult, has been so considered. I suppose next year the examination paper must be more elementary. This is to be regretted. In the answers some knowledge of the application of algebra and trigonometry is shown, but to no great extent.

Principles of Mechanics.—Pleased as I am with the evidences of considerable knowledge on the part of the majority of the candidates, yet my pleasure is mixed with some regret in seeing a want of clearness and perspicuity, which spoils the effect of the results, and renders it a difficult task to assign fairly the marks due to them. I have never been obliged to send you a qualified report before, but on this occasion I think that a word of caution to the candidates as to more earnest effort to secure method, well-digested arrangement and neatness of their papers will be for their good. I am glad to be able to mention one exception to the defect which marks the generality of this year's papers.

Practical Mechanics.—I have been unable to award any certificates of the first or second class. I believe that this is the first occasion upon which so unfavourable a result has occurred, and it has been very apparent to me that the candidates have not entered with sufficient care upon the course of reading pointed out for their guidance.

Electricity and Magnetism.—The examiner has much pleasure in reporting that one of the two most universal practical applications of this subject, namely, electro-telegraphy, appears this year to have received more attention than heretofore. The other not less universal application to the mariner's compass, its construction, its deviations, and the most practicable methods of correcting the errors therein arising, does not yet appear to command the attention of advanced students to the extent the subject is entitled to, considering the present vast and increasing importance of iron in marine architecture.

Light and Heat.—The candidates have all shown considerable knowledge of the properties of light and heat, which form important portions of Natural Philosophy. They have all, however, shown the need of more exercise in answering examination questions, so as to enable them to make the best use of their acquired knowledge during examinations, by answering each question completely, and yet in a condensed, distinct, and accurate manner, giving also the figures correctly where required.

Chemistry.—There are distinct evidences in the papers that candidates pay more attention to analytical chemistry than was the case some years ago. But still there is considerable room for improvement in that direction. I believe that many teachers of chemistry are hardly aware how easy it is to give practical instruction in elementary qualitative analysis to students without great expenditure of time or money. Every course of instruction in chemistry might include practical exercises of that kind.

Mining and Metallurgy.—The observations of last year are equally applicable to this. None of the papers exhibit a degree of excellence worthy of special remark.

Botany.—Of the twelve candidates this year, three have not complied with the required conditions as to the number of questions to be answered in each section. The only candidate passed in the first-class left five questions unanswered, but the answers given indicate a well-grounded acquaintance with the subject. The two papers of the second class are of tolerable promise, and improved by another year's experience would probably rank higher. All candidates would do well to handle living plants more frequently, dissecting and describing them as they go on in accordance with the examples given in the works recommended to them as text-books.

Animal Physiology.—The results of the examination this year show that, out of eighty-four candidates, four are in the first class, twelve in the second, eighteen in the third, and fifty are not placed. Since both teachers and pupils and self-taught students may be supposed to have learnt, by the issue of previous examinations, that *real merit*, in its several degrees, can alone obtain the several orders of certificates, it seems, at first sight, disheartening that the results are not more satisfactory. Of the fifty candidates "not passed," thirty-three have obtained only 20 per cent., or less, of the full number of marks; and I have no hesitation in describing these as immature students, even of their own language, prematurely offering themselves for an examination in so special a subject as Physiology. The first paper in the first class is admirable, a few slips only depriving it of the

full number of marks. There are a few papers in classes 2, 3, and 0, which fail to take higher places from deficient *quantity* of answers, the quality being good of what they contain. To justify my strictures on the majority of thirty-three of the fifty unpassed papers, I append a few examples of the sort of delinquency which I maintain unfit the authors of them for being candidates in an advanced science:—

I.

Errors in scientific terms which may be more or less excused, perhaps:—

Membranum tympanum .... / Membrania tympani	*for*	membrana tympani
Cancellæ	,,	cancelli.
Liquor sanguinus capilliaries	,,	liq. Sanguinis capillaries.
Mammils .... / Mammiles	,,	mammals.
Gelitenous	,,	gelatinous.
Carbonacieous	,,	carbonaceous.
Sacchrine .... / Sachrine	,,	saccharine.
Neucleus	,,	nucleus.

II.

Errors in English, unpardonable:—

Ouses	*for*	oozes.
Air-like vessels	,,	hair-like vessels.
[Take] panes	,,	pains.
A not	,,	a knot.
Fowl [air]	,,	foul.
Hear	,,	hair.
Respiar	,,	respire.
Differant	,,	different.
Suffication	,,	suffocation.
A sleep	,,	asleep.
Ere	,,	ear.
Aire	,,	air.
As	,,	has.
Byle	,,	bile.
Increditable	,,	incredible.
Ordours	,,	odours.
Two	,,	too.
Secrets	,,	secretes.
Togeather	,,	together.

The use of two l's for one is constant, as in "ventillation," "controll," &c. Such phrases as these occur—"is for to make," "greatest of nicety," "inodorous smells" [used twice in the same answer, so the incongruity is not accidental, but in the writer's mind], the blood is "also contaminated" by saline constituents which are natural to it—and so on.

III.

Errors of a special kind and absurd:—

1. "Pancreas" means "sweet," means "sweet-bread;" is so-called, *i.e.*, pancreas, because it is "sweet," because it is "acrid;" it lies "behind the back;" it is a "bag;" it is "above the diaphragm." 2. Bone is formed of "mucous" matter outside, and of "nervous" matter in, the latter being partly grey and partly white; it is made of "cells" and "sacs." 3. Bone "consists of long layers of cartilage arranged in *a very nice manner*;" "it has a pleasing structure." "4. The red blood corpuscles each contain a gland and a duct," but "it requires a great power of the microscope to find them." 5. The "external auditory meatus," being confounded with the "alimentary canal," by two candidates, is described as "twenty feet long, one and a half inch wide, and going zigzag through the abdomen, &c." 6. The "Eustachian tube" assists in breathing," "it exists," the same writer adds, "in man, ourang-outang, and all kinds of monkies;" "it carries away wax;" "it carries away mucus and excess of air after it has been used for making vibrations;" "it prevents choking;" it is "connected with the labyrinth, and only exists in those classes of animals *who* have a keen sense of hearing, as the deer, man, &c.;" it "carries away effete or superfluous matter into the nasal cavity." 7. Reflex movements are such as the "secretion of gastric juice;" by sensori-motor movements "we act as we think proper." As two final examples I transcribe the following literally:—"The osseous tissues present a very pleasing structure under the microscope, the majority of them being of a circular-like shape, with a kind of a neucleus in the centre, and are so adapted to fit closely together and form a compact mass, and are so small that they are easily carried along with the blood to that portion of the bone that needs nutrition." 2. In answer to a question on the uses of the blood and of its several parts, a candidate's *sole* reply is this—"The blood is said to be the life of the body, for there is no part of our body, if an incision be made in, the least whatever, some portion will come out. It also helps to nourish and build up this goodly frame of ours. Its constituents are, in a pure state, salts, albumen, fibrin, red and white corpuscles, these may be found in coagulated clot." The inaccuracies, the confusion of thought and expression, and the bad grammar, punctuation, and orthography, illustrated by the above examples of errors, constituted about *one-third* of what a strict scrutiny would reveal. Unless dealt with firmly such defects may increase. Nay, in my opinion, they require exposure, and public notice of some kind or other. At all events, advice should be given to future candidates or their teachers, as, indeed, I gave last year. If a strict hand be not held over them, the examinations of the Society of Arts in the subject of "Animal Physiology" will do not only no good, but a large amount of evil.

Domestic Economy.—The answers sent in this year on this subject show a gradual improvement over past years, and are better than in any previous examination which I have had, some of the answers showing a knowledge of the nature and composition of food, &c., and that the writers of them have profited from such papers as those of Dr. Lyon Playfair, in *Good Words*, and altogether making one feel that their knowledge may be useful to them in every-day life.

Geography.—I am better satisfied, on the whole, with this year's papers than with those of any former occasion. A large number of them reach a fair, and several a very high, degree of merit. There are, indeed, several failures; but, taken altogether, the answers give evidence of more preparation and of study directed to a definite purpose, than I have hitherto observed. This is an advance in the right direction. In geography, as in other subjects, diligent and methodical study, directed by progressive stages towards a definite object, can alone lead to success. The first-class papers of this year do very great credit to the writers.

English History.—The answers on this subject are, on the average, better than those of last year; though a few are so bad that it is difficult to understand how their authors can have been advised to offer themselves for examination on this subject. Those who are placed in the first class have laid a good foundation for future reading; but those in the second are generally deficient in accuracy as well as in quantity. Perhaps the period proposed as the subject for examination is too long. If by shortening it more accurate knowledge could be secured, the change would certainly be for the better. With regard to the form of the answers, there is a great improvement this year; and, with a view to maintaining this advance, it may be worth while to repeat the suggestion made last year—that candidates should practice themselves in answering questions on papers for their tutors from time to time.

English Literature.—The papers which I have now examined are certainly not less satisfactory than those of any previous year. There are but very few of them in which the candidates have not proved their sound ac-

quaintance with the text of the books in which they have been examined. A good proportion of the answers are well expressed, and show thoughtfulness and judgment. But two or three of the candidates have wasted their time in making imperfect, though tedious, grammatical analyses of the passages contained in the questions. As I have met with the same in some former examinations, I think it best to give a caution on the subject. It should be understood that no marks can be given for anything beyond an answer to the examiner's questions.

Logic and Mental Science.—Nearly all the candidates show very fair preparation in the subject of logic, and a few more than a popular acquaintance with it. The papers on mental and moral philosophy are not generally so good, and mostly evince a hasty preparation of the subjects. Some of the candidates, however, show a very fair acquaintance with one or even two of the prescribed text-books.

Latin and Roman History.—The work has a little fallen off both in quantity and quality.

French.—On the whole this year's papers are very satisfactory. It is true that I can only recommend four candidates for a first-class certificate, and that for papers which only just reach the standard. Nor are the second-class certificates numerous either; but I am able to award no less than fifty-one third-class certificates, which raises the total number of successful candidates to about three-fourths of the whole number, a proportion considerably larger than on any previous occasion, whilst the standard this year is certainly not lower. The chief cause of this result is the fact that the candidates have mostly confined their attention this year to one section of the examination paper, instead of attempting to give unconnected fragments of the different sections, as was too much the case previously. Altogether the candidates seem to have gone more methodically to work, which is in itself a great progress.

German.—In comparing this year's papers with those of last year, I am happy to find that in every section they are distinguished by greater ability and bear the marks of closer application. Not one candidate had to be rejected. Only six out of nineteen did not write the essay; some of those, however, who have done so, sometimes deviate from the point in question. A stricter keeping in view of the subject to be handled, and a more logical method of arranging the matter, ought in future to be aimed at. The questions on Grammar are answered with greater precision than last year, and the majority of the translations from German into English are very good. The gainer of the highest number of marks has mastered all the four pieces selected for translation, and left hardly any part of the examination paper untried.

Italian.—The papers, with one single exception, are highly satisfactory. The candidates have shown that their knowledge of Italian exceeds the average standard usually attained by many who yet are supposed to have mastered a foreign language. One paper evinces much readiness, if not style, in translating into Italian; and all show careful grammatical studies, and a fair acquaintance with the peculiar idioms.

Spanish.—Most of the candidates have tried for a higher certificate than their knowledge of Spanish seems to warrant, and a few only have complied with the requirements. This mistake has damaged the result of the examination of some who, in all probability, would have been more successful had they tried for a lower class certificate.

Free-hand Drawing.—Candidates for examination were requested to bring any drawings they had made during the last twelve months as proofs of their abilities; this gave each candidate an opportunity of showing what he had learnt, and what his taste was, if he had any peculiar talent. There were fifty-six candidates who sent in drawings of the following subjects:—Two, fruit and flowers; three original designs for manufacture; four, animals; seven, human figures, or portions of the figure; eight, landscapes; thirty-one, copies of scrolls and drawings of flattened leaves and flowers. This analysis shows pretty well what is being done for art-education throughout the country.

Geometrical Drawing.—Since the general nature of the examination in Practical Geometry must be better known from year to year, it might be expected to improve. This, I regret to see, is not the case,—the proportion of failures to the whole number is greater on this than on former occasions. It is well perhaps to point out again the apparent causes of these failures in the hopes of putting future candidates more on their guard against them. They are—1st. A neglect of the conditions of the questions, either arising from carelessness in reading them, or from misconception of their import; 2. Neglect of the repeated injunction not to attempt more than the prescribed time allows of being carefully and thoughtfully accomplished; 3. A want of knowledge of the elements of solid or co-ordinate geometry, causing a great loss of time by compelling the candidate to adopt complicated and circuitous constructions instead of the brief and simple ones based on sound elementary knowledge. It is but fair to the successful candidates to state that their work is highly creditable, as regards the neatness and accuracy of their drawing.

Music.—This year's are certainly, on the whole, the best papers I have yet had. Of the few candidates who have not passed, the failure is attributable (as on former occasions) to their having attempted the harmony and counterpoint questions, with insufficient or no preparation, to the neglect of those questions which possibly they might have answered correctly. The second-class papers—nearly half of those worked—are very creditable.

TABLE III.

This table shows the ages of the 1,369 candidates from whom return papers were received. Of these 1,199 underwent the final examination.

Age.	No. of Candidates.	Age.	No. of Candidates.
16	136	31	9
17	176	32	10
18	181	33	5
19	185	34	3
20	138	35	4
21	101	36	8
22	78	37	6
23	75	38	1
24	64	39	6
25	48	40	1
26	47	43	3
27	27	44	3
28	20	45	2
29	15	46	1
30	15	48	1
		Total	1,369

TABLE IV.

Occupations, Present or Proposed, of the 1,369 Candidates from whom Return Papers were received:—

Accountants [and Clerks]	11	Art-Student	1
Agents	2	Assistant, Building Surveyor's	1
Apprentice to Linen Manufacture	1	,, Corn Merchant's	1
Architects	4	,, Hotel	1
		,, Librarian's	1

Assistant, News Agent's	1
,, in an Observatory	1
,, Pawnbroker's	1
,, Registrar of Births, &c.	1
Auctioneer	1
Auctioneers' Clerks	2
Bakers	2
Bandsman	1
Bell-hanger	1
Blacksmith	1
Block-printer	1
Boat-builder	1
Bookbinders	3
Book-keepers	33
,, and Correspondent	1
Booksellers	3
Boot-closer	1
Brass-finishers	5
,, founder	1
Bricklayers	4
,, maker	1
Brushmaker	1
Builders	7
Butchers	2
Cabinet-makers	2
Card-maker	1
Carpenters	10
Carpet-weavers	5
Carver and Gilder	1
Cashiers	4
Caulker	1
Chain-maker	1
Chemists	20
,, and Druggists	14
Civil Engineers	2
Clerks, Architects'	2
,, Bankers', Commercial, &c.	392
,, Carrier's	1
,, Chemist's	1
,, Civil Service	3
,, Colliery	3
,, to Commissioner of Taxes	1
,, Customs'	2
,, Engineer's	1
,, Estate Agent's	1
,, Gas Office	2
,, Government	4
,, Insurance	5
,, Law, &c.	17
,, in Money Order Office	1
,, in Ordnance Survey Office	3
,, Post-office	1
,, Privy Council Office	1
,, Railway	12
,, Surveyor's	1
,, Weighing	1
Clog-maker	1
Cloth-cutter	1
,, finisher	1
Clothier	1
Coach-body maker	1
,, builder	1
,, painter	1
,, trimmers	2
Coal Agent	1
,, Dealer	1
Collectors	5
Colour-maker	1
Commercial Traveller	1
Compositors	4
Confectioners	2
Cooper	1
Cotton-piecers	10
Curriers	3
Customs' Officers	3
Dentists	2
Designers	5
Die-sinkers	2
Drapers, &c.	11
Draughtsmen	11
,, Architect's	1
,, Mechanical	1
Druggists, &c.	6
Drysalter	1
Dyers	2
Engineers	66
Engine fitters	6
,, keeper	1
Farmer	1
Fire-beater	1
Fitters	10
Foreign correspondent	1
Foremen	4
Gardeners	7
Gas-fitter	1
Gas-meter inspector	1
,, maker	1
Glass-cutter	1
,, painter	1
Gold-beater	1
Governesses	4
Grocers, &c.	12
Harness maker	1
,, weaver	1
Holy orders	2
Housekeeper	1
Inland Revenue officers	3
Iron-founder	1
Iron-merchant	1
,, mongers	4
,, turners	4
Jewellers	6
Joiners, &c.	17
Knotter	1
Laboratory assistant	1
Labourers	4
Leather dealer	1
Letter sorter	1
Lithographer	1
Lithographic printer	1
Lock manufacturer	1
Machine joiner	1
Machinists	2
Makers-up	2
Manager	1
,, at magnesium works	1
Masons	3
Measurer	1
Mechanics	37
Medical students	4
Messengers	2
Milkman	1
Millwrights	10
Minder	1
Miner	1
Mining engineers	2
,, surveyor	1
Missionary	1
Model-maker	1
Moulder	1
Muslin-man	1
Needle-hardener	1
Oil-cloth-maker	1
Oilman	1
Optician	1
Overlookers	5
Packer	1
Painters	3
Pattern-makers	3
Pawnbroker	1
Perfumer	1
Picture-frame-maker	1
Photographers	2
Photographic apparatus maker	1
Piece-looker	1
Plasterer	1
Plumbers, &c.	5
Porters	2
Post-messenger	1
Printers	5
,, reader	1
Pupil teachers	54
Railway porter	1
Registrar of Births and Deaths	1
,, to a public company	1
Roller-coverer	1
Rural messenger	1
Saddler	1
Saddler's ironmonger	1
Sailmaker	1
Sailor	1
Salesman	1
Schoolmasters	7
,, mistress	1
Self-actor minder	1
Sergeants of police	2
Shawl-pattern designers	2
,, weaver	1
Shipwrights	26
Shoe-dealer	1
,, makers	3
Shopmen	2
Shorthand writer	1
Silk-sizer	1
,, weavers	2
,, winder	1
Silversmith	1
Smiths	3
Soap-manufacturer	1
Spinners	10
Spur-plater	1
Staff-sergeant	1
Stationers	4
Steel-pen tool maker	1
Stoker	1
Stone cutter	1
,, mason	1
Storekeeper	1
Students	2
Surgeons	2
Surveyors, &c.	2
Tailors	4
Teachers' other than pupil teachers	39
Throstle overlookers	2
Time keepers	3
Tin-plate workers	2
Tobacco manufacturer	1
Tobacconist	1
Turkey-red dyer	1
Turners	10
Upholsterers	4
Vellum-binder	1
Viewers [Tower]	2
Warehouse men and lads	56
Watchmakers	3
Weavers	53
Wheelwright	1
Whipmaker	1
Whitesmith	1
Wire-drawer	1
Wood-carver	1
Wool-sorters	7
Wool-stapler	1
Woollen manufacturer	1
Writers	6
Undetermined, or not given	39
Total	1,369

The report of the discussion will appear in next week's *Journal.*

Fine Arts.

MONUMENT TO EUGENE DELACROIX.—A monumental tomb has just been raised over the remains of the painter Delacroix, in the cemetery of Père la Chaise. It is executed, according to the desire of the deceased, in the severest style of Greek art, and consists of a simple parallelogram of Volvic stone, placed upon a granite base—in fact, a copy of the "Tomb of Scipio"—and bearing no other inscription than the name of the deceased. A number of artists and friends of the late painter attended the ceremony; and discourses were pronounced by M. Rivet and by M. Berryer, who spoke impromptu at the urgent request of those assembled.

MONUMENT TO PEDRO IV. AT LISBON.—Two French artists, M. Daviond and M. Robert, have obtained the first prize in this competition; a native artist obtained the second, another French sculptor the third, and the fourth and fifth were awarded to Italians. The design is new, and deserves a few words of description. The monument will consist of four parts—a basement of granite, a pedestal, a column, and a statue. At the angles of the square basement are four seated figures, representing Prudence, Justice, Force, and Temperance; the effect of these is to connect the whole design, and lead the eye naturally from the base to the summit. On the walls of the basement are sculptured the arms of the

twenty principal towns in the kingdom, indicating the popular unanimity of the nation in the work. On the pedestal are inscribed the facts which gave rise to the monument. The column is decorated with four figures of Fame, in bas relief, on its lower portion, and these figures are connected together by garlands. The capital of the column is decorated with the cypher and arms of the king, in the midst of palm branches and symbolic flowers. The figure of Don Pedro IV. is dressed in a general's uniform; the right hand holds the constitution which he inaugurated, while the left rests on the hilt of the sword. This statue is to be ten feet high, cast in bronze, and gilt by the electro-galvanic process. The entire monument will be nearly one hundred and forty feet high.

Exhibition of Caricatures.—The whole of Europe and France in particular is just now full of exhibitions—agricultural, industrial, artistic, and miscellaneous. One of a new kind is talked of in Paris at the present moment—an Exhibition of Caricatures. There is little doubt that such a collection might be made extremely interesting, but at the same time there would be some difficulty in knowing what to admit and what to exclude. Not only would the political question raise some difficulties, but many of the productions which a hundred years since were considered only grotesque could not now certainly be exhibited in public. Such an exhibition, moreover, could not well be made international; few nations would like to show how they sketched others in past times, or to see how the caricaturists of other nations treated them.

Commerce.

Preservation of Ships.—A communication has been made by Lieutenant A. Mariot, of the French navy, relative to the means employed by the Cochin-Chinese to protect the hulls of vessels from the attacks of the auger-worm and other mischievous creatures. M. Mariot declares that the Chinese and Annamites know how to protect their vessels effectually, and at a very small cost, and a long residence in the two countries as a naval officer gives weight to his evidence. He was struck with the extreme antiquity in appearance of many of the native vessels, and found on inquiry that they were quite as old as they looked, and that in some cases they had been bequeathed from father to son until their origin was entirely forgotten. The timber of these vessels being the same as that employed in India for the same purpose, and the waters of Cochin-China teeming with destructive creatures, it was evident that the durability of the vessels arose from some special precaution. The means employed are, according to Lieut. Mariot, a mixture of a resinous oil with a resin, applied hot to the wood; both the substances being special products of the lands on the banks of the river Meikon, the trees which yield them having heart-shaped leaves, strong roots, and throwing out suckers. The tree which yields the oil is called by the Annamites caydau, literally oil-tree, and often attains a height of more than two hundred feet; it will furnish from three to five pints of oil per week. Boats made of the wood of this tree are said never to be attacked by the auger-worm. The tree which yields the resin is described as being somewhat similar to the former. M. Mariot, when in command of the *Amphitrite* lorcha, under Admiral Charner, employed the native mixture on a boat which had been attacked by the mollusks, and at the end of a year it was perfectly free from any fresh attacks.

Guano in France.—A large deposit of guano, the produce of bats, has been discovered in a natural cave, belonging to the Commander de Beaufond, eight miles distant from Vesoul, in the department of the Haute-Saône. The deposit is estimated at about eight hundred cubic metres. This discovery recalls another which was made many years ago by Mr. George Windsor Earl, now magistrate at Penang, and published in London about the year 1854. This gentleman, in his geographical and ethnological researches, discovered that vast caves in the innumerable islands of the Indian Archipelago were filled with the *detritus* of bats, which are of enormous size in those latitudes, and have existed there by myriads, almost undisturbed, for ages. Mr. Earl says that the amount of guano in those islands is incalculable. A French chemist has analysed the guano of Vesoul, and considers it valuable as manure, a fact which helps to validate Mr. Earl's discovery, as both deposits are produced by the same creatures.

The Exhibition at Bombay.—The promoters of the proposed Great Exhibition at Bombay are losing no time in pushing forward the scheme. Already a Building Committee has been formed who will superintend all the necessary arrangements. Another has been appointed for India, one for China and Japan, one for Australia and the Cape, one for Persia and Egypt, one for Europe (to correspond with the London Commission), and one for America (corresponding with the New York Commission). A District Committee is formed for regulating the arrangement of all the articles in the building, and Government has been applied to in order to form official committees throughout India.

Colonies.

Intercolonial Customs.—It appears that Victoria is going in the direction of protection, while South Australia, which is contending with it for the trade of Western Riverina, is being urged by others to go to the opposite extreme—of an immediate abolition of the Custom-house. A proposal to that effect was brought forward in the Chamber of Commerce at Adelaide, but it does not appear to have excited much attention. Only 30 attended and only 19 voted. The result was that 14 persons expressed themselves in favour of an immediate abolition of the Custom-house. It was argued that a moderate increase of direct taxes would enable the revenue to dispense with the Custom-house, but how it was to be collected or what it would cost was not gone into. The special reason which makes the policy of South Australia interesting to New South Wales is, that, if it were to adopt the system of open ports, it would either compel New South Wales to do the same or put it to great expense to guard against smuggling. If spirits were admitted duty free into South Australia, how are they to be kept from the back territories of New South Wales? It would pay to cart the contraband commodities for long distances towards Sydney, perhaps into Sydney itself. A preventive service on the River Murray would be very inconvenient, and perhaps not effective, although New South Wales has only to guard against goods that have paid full duties. How much more troublesome to guard against the introduction of goods that have paid no duties at all. South Australia is, perhaps, in a better position to be able to dispense with customs dues than any of its neighbours.

Obituary.

Sir Joseph Paxton, late M.P. for Coventry, died on Thursday, the 8th inst., at his house, Rockhills, Sydenham. He was the son of poor parents, and was born at Milton Bryant, near Woburn, Beds, in 1803. Having while very young to seek his own livelihood, he became a gardener, and in that capacity obtained a situation to work in the gardens of Sion House. He rose to the post of foreman, and was gradually promoted by the Duke of Devonshire to the position of director of the garden at Chatsworth, and afterwards to that of manager of the Derbyshire estates belonging to the duke. He remodelled the whole of the gardens, and the many magnificent works now standing there were carried out under his direction. Amongst them was the great conservatory, a glass and iron structure, 300 feet long, which he made

the model for the great building in Hyde-park, and then of the present Crystal Palace at Sydenham. His design for the erection of a building to be constructed of glass and iron, for the Great Exhibition of 1851, was accepted by the Royal Commissioners, after 233 plans had been rejected. For his public service on this occasion he was knighted. In 1853 he commenced the building of the Crystal Palace, which was completed and opened to the public in June, 1854. In the same year Sir Joseph offered himself as a representative for Coventry, in place of his friend Mr. Geach. He was elected without opposition, and retained his seat till a few weeks ago. Shortly after his election he tendered to the Government a practical suggestion to send out a corps of navvies to perform civil work at the siege of Sebastopol, then going forward. The proposal was accepted, and he was entrusted with the organisation of the Army Works Corps—a duty which he discharged with great credit. In politics he was a Liberal, and a consistent supporter of Lord Palmerston's administration. He followed the profession of an architect and civil engineer from the time when he constructed the great glass building in Hyde-park; but he did not relinquish his position at Chatsworth. He was happy in the constant esteem of the late Duke of Devonshire, who, some time before his own death, handed to him a life-policy for £20,000, upon which he charged himself to pay the premiums for Sir Joseph's benefit. Sir Joseph Paxton was an industrious writer on horticulture, and connected with several literary enterprises. He was a Fellow of the Horticultural Society, 1826; of the Linnæan, 1833; and in 1844 he was made, by the Emperor of Russia, a Knight of the Order of St. Vladimir. The Silver Medal of the Society of Arts was presented to him in 1840, for a communication respecting his invention of a machine for the purpose of making sash bars, the account of which is given at page 87, vol. 53, of the *Society's Transactions*. He was elected a member in 1850, and was a Vice-President at the time of his death.

Notes.

The Co-operative Principle in France. — The *Builder* states that the chief instances of application of principles of co-operation in the building trades are to be found in France. Somewhere about twenty-three years ago, M. Leclaire, the house painter, whose experiments in connection with painters' work have often been mentioned by us, described in a pamphlet the system adopted in his establishment, and gave the reasons that led him to establish it. At present the concern is a partnership, consisting of M. Leclaire himself, M. Defournaux, and the Société de Secours Mutuels, of which all persons in the establishment are members. In the first year the men who worked 300 days made each 300 francs (£12) as the profit, or beyond the wages, which were 4 francs a day. Improvement in the habits and demeanour of the workmen was immediately manifest. M. Chevalier, in 1848, stated, on the authority of M. Leclaire, "that the increased zeal of the workpeople continued to be a full compensation to him, even in a pecuniary sense, for the share of profit which he renounced in their favour;" and in 1857, M. Villiaumé gave similar testimony. The passing of the Limited Liability Act first made similar associations possible in this country. Of successful associations of operatives alone there are in Paris upwards of one hundred. The chief of these associations is that of the masons. Its amount of business done from 1852 to 1858, both years inclusive, has increased from 45,530f. in the former year to 1,231,461f. in the latter, and its profits from 1,000f. to 130,000f. It lately paid 56 per cent. as the dividend of the year on the capital. M. Villiaumé remarks that intemperance greatly decreases amongst the members of the different associations, as well as everything of the nature of coarseness and rudeness. Mr. Mill, and all who have studied the subject, expect a great increase in the productivenes of industry from the advance of the co-operative movement.

Correspondence.

On the Wear and Tear of Steam Boilers.—Sir, —Anybody who chooses to read my two "double-barrelled" letters—each barrel of which seems to be regarded by Mr. Clark as a modern form of the horns of a dilemma—will find convincing proof that Mr. Clark has again been drawing upon his memory for his discoveries, and upon his imagination for his claims. The ostrich-like style of defence that consists in ignoring statement and argument alike, and the lady's reasoning of continued iteration, can be of no avail to my respected neighbour with those who will give themselves the trouble of reading my "double-barrelled" epistles, as they are termed by Mr. Clark. Just, however, as even a Colt's revolver is of no use against the hide of a rhinoceros, so will no "double-barrelled" epistle—perhaps not even a round robin—be of any effect against Mr. Clark's own tough cuticle. I must confess, however, that this is quite indifferent to myself. Mr. Clark's little weaknesses on the subject of steam boilers are pretty generally known by this time. "That's my thunder—that my explanation of explosions," are perennial cries with the sage of the Adelphi, as of yore with Dennis the actor. Like another great man, he delights in fighting for ideas—and for ideas which he may annex, but certainly has never discovered. Mr. Clark's practised and boa-constrictor-like powers of literary deglutition are indeed fully recognised. The publicity, in fact, of the existence of Mr. Clark's little self-delusions on this score forms my protection. This will probably be the case even with that majority of your readers who do not care the value of an old bolt for either Mr. Clark or myself, therefore I must say that, for my own part, I do not so much regret his assertion that I have borrowed ideas from him without acknowledgment as my implied belief in the unscientific and mistaken twaddle which Mr Clark dignifies with the title of explanations of the pitting and furrowing of steam boilers. In the one sentence by which Mr. Clark attempts to explain pitting, he is seemingly unaware of the existence of such an action as chemical affinity; and in his "explanation" of furrowing he has never dreamt of that action of internal fluid pressure which tends to form a perfect cylinder. As regards pitting, all Mr. Clark's explanation is contained in one single sentence—a sentence, by the way, which he introduces with the remark "that we are aware that electrical and galvanic action are adduced in 'explanation'" (of furrowing and pitting). "But these words," continues Mr. Clark, "have two meanings—they mean electricity and galvanism, and they mean igorance and mystery." We see here, as plainly as anything written can be plain, that Mr. Clark expressly repudiates galvanism as accounting for pitting. We now come to that single pregnant sentence which, like a Delphic oracle, contained everything yet in the womb of the future. Instead of "ignorantly" having recourse to galvanism, Mr. Clark says—"The pitting of the metal is readily explained by the presence of chemical agents in solution in the water, *and the known inequality of substance of iron plates and bars, in consequence of which the metal is gradually but unequally separated and dissolved*, and probably a weak galvanic circuit may be established between the iron shell and the brass tubes, accelerating the process of dissolution." Only in that portion of the sentence which I have italicised is there to be found any attempt at explaining the irregular pock marks of pitted plates; the latter portion is, as I have shown, copied from Professor Tyndall, and could, in any case, only account for an equally spread corrosion. What Mr. Clark says, neither more nor less, is, that some

spots of the metal are softer than others—an isolated physical fact that could not, *per se*, explain why any softer or harder spot should be sooner dissolved than any other. He simply says, that some portions are easier dissolved than others, from being softer than others. In fact, it amounts to no explanation at all. Years ago I have heard a stoker explain pitting in this way; and Mr. Clark has simply clothed it in a Johnsonian sentence. In a similar mode Mr. Clark talks of "the indirectness of the strain of the steam pressure" at the joints, which is quite a different explanation from that which ascribes furrowing to the mechanical tendency to produce a correct circle, and to the furtherance of corrosion in the absence of that protecting coating of incrustation which is continually being broken off by the mechanical action. I defy Mr. Clark to show that either of these points, amongst others, have been even alluded to by himself. As to the explanations I give of the deterioration of stay-bolts, the best joke is that they are quite distinct from that of Mr. Griggs, published five years before its assimilation by Mr. Clark. Rightly or wrongly, I import novel elements into the matter. I can only suppose that Mr. Clark has not done me the honour to read what I have written, and that, misled by a strange self delusion of which he has given previous proofs, he has claimed the explanations from the mere fact of their dealing with steam boilers.—I am, &c., F. A. Paget.

18, Adam-street, Adelphi, W.C.

[This correspondence must end here.—Ed.]

Atmospheric Railways.—Sir,—The atmospheric railway proposed to be laid down along the banks of the Thames is neither more nor less than the invention of the late Mr. Vallance, the well-known banker at Brighton. Thirty or forty years ago that gentleman laid down an experimental vacuum railway of one quarter of a mile in length, of the full size, and carried passengers up and down for some time very successfully. The only difference in detail between the present plan and the former is, that the exhaustion is intended to be applied at one end only, and pressure for the return trip, a variation that will not ultimately be found to answer, the object in the present plan being evidently to avoid the expense of an exhauster at each end. In practice, however, there is a very great difference between exhaustion and compression. In the former case the action seems to be instantaneous, while in the latter the effect is unaccountably retarded, owing perhaps to the elasticity of the atmosphere combined with the friction in the tube. Under the compressed system it has been found that if the pipe of communication be sufficiently long, the most powerful forge blast will not blow out a lighted rushlight placed at the further end.—I am, &c., Henry Reveley.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Asiatic, 8.
Tues. ...Statistical, 8. 1. Mr. Lubbock, "On the Statistics of the Clearing House." 2. Mr. Levi, "The Economic Condition of the Highlands and Islands of Scotland."
Wed. ...Meteorological, 7. Annual Meeting.
Geological, 8.
R. Society of Literature, 4½.
Thurs...R. Society Club, 6. Annual Meeting.
Zoological, 4.
Sat.......R. Botanic, 3¾.

Patents.

From Commissioners of Patents Journal, June 9th.

Grants of Provisional Protection.

Buttons, manufacture of—1110—T. Greaves and J. S. Wright.
Carpets, manufacture of—1499—W. Edwards.
Casting, apparatus for making cores for—1429—D. Law & J. Bennett.
Chimnies, preventing downward draft in—1471—E. Myers and J. Stodard.
Circular saws—1475—W. T. Hamilton.
Coke, ovens for the manufacture of—1435—J. Gjers.
Cotton, hydraulic presses for packing—1280—E. T. Bellhouse and W. J. Dorning.
Cotton, rollers used in preparing—1439—W. E. Newton.
Drain pipes, apparatus for laying—1396—W. Eddington.
Fire-arms—1433—E. Paton.
Fire-arms, breech-loading—1461—T. Bissell.
Fire-arms, breech-loading—1356—R. A. Brooman.
Furnaces—1451—M. Cohen.
Furnaces—1469—P. Young.
Furniture, construction of vans for transporting—1495—F. Hazeldine.
Gas burner—1437—G. Bray.
Hoops, &c., manufacture of—1425—J. Ramsbottom.
Iron, manufacture of—1310—J. Bennett.
Knitting machines—1445—W. Clark.
Lamps—1422—C. E. Moller.
Lathes, rests for ornamental turning—1441—T. H. Hoblyn.
Lime, manufacture of—1467—P. A. le C. de Fontainemoreau.
Locks, keys of—1485—S. Grafton.
Locks—1487—J. Calvert.
Locking screws—1473—F. A. Paget.
Machines, reaping and mowing—1371—W. Manwaring.
Machines, rotative—1447—J. A. Heinrich.
Oils, purifying animal and vegetable—1453—S. Sequelin.
Pendants, sliding gas—1381—G. H. Brookes.
Railway trains, communication between passengers and guard of—1493—I. Rogers.
Sail cloth, printing upon—1006—J. Isherwood.
Screw gills—1419—T. Beanland.
Ships' bottoms, paints applicable to—1489—T. Spencer.
Ships, apparatus for steering—1394—J. Martin.
Ships, machine for loading and discharging cargoes from—1449—G. Elliott and R. P. Clark.
Spherical form, machinery for turning bodies of a—1459—T. Bourne.
Spinning machinery—1483—M. Meisel.
Steam boilers, composition for preventing incrustation of—1324—W. Hewitt.
Steam boilers, furnaces of—1372—T. Molden, J. Newsome, and J. Akeroyd.
Steam hammers—1491—P. Pilkington.
Telegraphic supports—1390—C. and A. Varley.
Tires, cast-steel railway—1455—J. M. Rowan.
Trimming, manufacture of—720—J. P. Booth.
Tubes, apparatus for cleaning the interior of—1479—J. Hare.
Weaving, looms for—1427—D. Welsh.
Whales, rocket guns for the capture of—550—T. W. Roys and G. A. Lilliendahl.
Writings, &c., producing copies of—1457—R. A. Brooman.

Invention with Complete Specification Filed.

Gas burner—1494—H. Monier.
Ordnance, fuses for rifled—1552—G. Haseltine.

Patents Sealed.

3082. R. H. Johnson.	3123. W. Cotton.
3103. C. P. Coles.	3133. W. Brookes.
3104. S. Hood.	3137. Z. Eastman.
3107. A. F. J. Claudet.	3147. H. F. McKillop.
3114. W. E. Gedge.	3178. H. Edmonds.
3119. F. A. Chevallier.	3252. L. P. E. Max.
3120. G. Brown.	178. J. Snell and W. Renton.
3121. J. White.	

From Commissioners of Patents Journal, June 13th.

Patents Sealed.

3108. J. A. Pols.	21. J. Knowles.
3118. R. A. Brooman.	44. B. Dobson, W. Slater, and R. Halliwell.
3122. W. McNaught.	77. H. Chamberlain.
3125. M. J. Haines.	82. J. F. Spencer.
3126. J. L. Norton and W. Ainsworth.	107. J. B. Hill.
3134. R. A. Brooman.	127. J. Young.
3136. H. L. Hall.	164. R. Mallet.
3158. G. Leach.	180. W. Clay.
3163. J. P. Llagostera.	228. J. Hamilton, jun.
3210. T. Whitley.	248. B. Dobson.
3213. J. Wolstenholme.	291. A. Murray.
3219. J. Dodge.	443. E. B. Wilson.
3227. W. H. Preece and A. Bedborough.	476. A. Sharp.
3250. T. Bouch.	538. P. A. le Comte de Fontainemoreau.
5. J. F. Parker & J. Tanner.	

Patents on which the Stamp Duty of £50 has been Paid.

1708. A. V. Newton.	1760. C. A. Tyler.
1723. A. Knowles.	1714. J. Lovegrove.
1732. J. B. Ingle.	1738. W. Holland.

Patents on which the Stamp Duty of £100 has been Paid.

1292. J. Bunnett.	1321. G. Bartholomew.
1305. P. Dumont.	

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, JUNE 23, 1865. [No. 657. Vol. XIII.

TABLE OF CONTENTS.

TREASURER'S STATEMENT OF RECEIPTS, PAYMENTS, AND EXPENDITURE, FOR THE YEAR ENDING 31st MAY, 1865.

Dr.	£ s. d.	£ s. d.
Cash in hands of Coutts and Co., 31st May, 1864 ...		229 9 8
To Subscriptions for the year, from Members and Institutions in Union		5,861 13 6
Life Contributions		207 18 0
Legacy		21 0 0
Sale of Stock, Consols		1,601 1 6
*Dividends on Stock:—		
Consols ... £6,530 18 0		
Reduced by Sale of ... 1,783 18 7		
£4746 19 5	164 18 10	
†£388 1s. 4d. New 3 per Cents	11 7 2	
‡52,000 Rupees, Indian 5 per Cent. Rupee Paper	258 0 0	
		434 6 0
To Examinations:—		
Prince Consort's Prize		26 5 0
Dr. Temple	5 5 0	
C. Brooke, Esq., F.R.S.	2 2 0	
Harry Chester, Esq.	4 0 0	
Sir C. W. Dilke, Bart.	10 0 0	
Dr. Skey	1 1 0	
Fees	6 8 6	
		28 16 6
To Rent, Rates, and Taxes	0 10 0	
Sale of Books	5 12 0	
Jury Reports	192 12 7	
Farmers' Club	1 10 0	
Art-Workmanship Examples	59 11 6	
		259 16 1
South Australian Institute		552 10 10
		£9,222 17 1

Cr.	£ s. d.	£ s. d.
By Rent, Rates, and Taxes	206 13 8	
Insurance, gas, coals, and house charges	170 13 2	
Salaries, Wages, and Commissions	1,678 18 0	
Postage, Stamps, and Parcels	126 10 11	
Stationery and Printing, including List of Members	178 10 1	
Advertising	84 18 10	
Working Classes' Museum	80 14 1	
Journal, including Stamps and Distribution to Members	1,576 15 7	
Union of Institutions, including Examinations, Prizes, Postage, Stationery, Printing, &c.	560 19 5	
Prince Consort's Prize	26 5 0	
Artistic Copyright	0 4 6	
Conversazione	164 8 8	
Repairs and alterations	1,108 18 7	
Jury Reports on Exhibition, 1862	1,274 16 3	
Art-Workmanship Prizes	498 10 6	
Society's New Medal	83 4 0	
Library, Bookbinding, &c.	129 12 11	
Swiney Prize	200 0 0	
Annuity to Mrs. Cantor	25 0 0	
Cantor Lectures	276 12 7	
Musical Committee	2 4 6	
Coachmakers' Exhibition Prize	5 0 0	
Society's Memorial to the Prince Consort	0 4 8	
Labourers' Dwellings Committee	41 17 8	
Distribution of Prizes	18 7 11	
Labourers' Cottage Prize	25 0 0	
Power of Attorney	1 1 6	
Maitland School of Arts	0 11 3	
South Australian Institute	380 14 0	
		8,927 8 3
Balance of Cash in hands of Coutts & Co.		295 8 10
		£9,222 17 1

Liabilities and Assets.

Dr.	£ s. d.	£ s. d.
To Sundry Creditors:—		
South Australian Institute	184 1 6	
Sir W. C. Trevelyan, Bart.	70 0 0	
Society's Memorial to the Prince Consort	545 15 10	
The Prince Consort's Prize	26 5 0	
Examination Prizes	185 0 0	
Examiners' Fees	226 16 0	
Tradesmen's Accounts	835 7 7	
		2,073 5 11
Excess of assets over liabilities		5,535 15 7
		£7,609 1 6

Cr.	£ s. d.	£ s. d.
*By Consols, £146 19s. 5d., at 91¼		134 2 9
‡Invested in Indian 5 per cent. Rupee Paper		355 2 7
Subscriptions in course of collection, £1,9?9 2s., valued at		1,600 0 0
Value of the Society's Lease of Premises		3,000 0 0
,, Other Property		2,000 0 0
Examination Prize Fund		36 5 0
Jury Reports in Stock		105 12 0
Bell and Daldy		12 10 4
Cash in hands of Coutts and Co.	295 8 10	
London and Westminster Bank	70 0 0	
		365 8 10
		£7,609 1 6

Trust Funds.

*Swiney Bequest	£4,500 0 0	Consols, liable to a charge of £200 once in five years.
*John Stock's Trust	100 0 0	,, liable to the Award of a Medal.
†Fothergill's Trust	388 1 4	New 3 per cents., liable to the Award of a Medal.
‡Cantor Bequest	5,049 9 7	invested in Indian 5 per cent. Rupee Paper.

SEYMOUR TEULON, } *Auditors.*
H. READER LACK, }
P. LE NEVE FOSTER, *Secretary.*

Society House, Adelphi, June 21st, 1865.

FINANCIAL STATEMENT.

The foregoing statement is published in this week's *Journal*, in accordance with Sec. 42 of the Society's Bye-laws, which provides that, at the Annual Meeting, the Council shall render to the Society a full account of their proceedings, and of the receipts, payments, and expenditure during the past year; and a copy of such statement shall be published in the *Journal* of the Society, on the Friday before such General Meeting.

ANNUAL GENERAL MEETING.

The One Hundred and Eleventh Annual General Meeting, for the purpose of receiving the Council's Report and the Treasurers' Statement of Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, will be held, in accordance with the Bye-Laws, on Wednesday, the 28th of June, at 4 o'clock.

The Council hereby convene a Special General Meeting of the Members of the Society to ballot for members, such meeting to take place at the close of the Annual General Meeting.

By order,
P. LE NEVE FOSTER,
Secretary.

Society's House, Adelphi, June 21st, 1865.

PRIZES FOR ART-WORKMANSHIP.

The Council have much pleasure in publishing the following letter:—

17th June, 1865.

DEAR SIR,—Referring to your letter of the 10th of January last, soliciting the co-operation of the Worshipful Company of Plasterers, London, in offering prizes for Art-Workmanship, I have now the pleasure to inform you that the Plasterers' Company have resolved to offer through the Society of Arts one prize of £10 and a second of £5 for modelling.

I send on the other side the particulars of the subject selected, and also the conditions, subject to which the prizes are offered, and I should feel much obliged if you would kindly make the same known as extensively as possible.

I am, dear Sir, yours faithfully,
H. MOTT.

P. Le Neve Foster, Esq., Secretary to the Society of Arts, Adelphi.

The Worshipful Company of Plasterers, London, offer (subject to the general conditions of the Society of Arts) a prize of £10 for the best floriated bracket or truss in the Italian Renaissance style—dimensions, 14 inches on the beam, 12 inches on the wall, and 8 inches on the face —to be designed and modelled by the competitor, or the designer and modeller may co-operate in the production, when £5 will be awarded to each.

Five pounds will be given for the next best model, or £2 10s. each to designer and modeller.

Artizans' apprentices and students may compete for these prizes, but not master tradesmen, Masters in Schools of Art, or those training for Masters in the Central School of the Department of Art.

To be delivered at the Society of Arts by the 14th December, 1865.

Proceedings of the Society.

FOURTEENTH ANNUAL CONFERENCE.

The Fourteenth Annual Conference of the Representatives of the Institutions in Union, and the Local Educational Boards, with the Council of the Society, was held at the Society's House on Wednesday, the 14th inst, at 12 o'clock, noon. WILLIAM HAWES, Esq., F.G.S., Chairman of the Council, presided.

At the conclusion of the Secretary's Report to the Council, read to the Conference, and published in the last number of this *Journal* (see p. 506), the Chairman laid before the Conference the proposed Programme of the Examinations for 1866, and called attention to the following subjects proposed for the consideration of the Conference:—

1. The establishment of organising teachers among the Institutes, on the plan adopted in the East Lancashire Union.
2. Is any modification of the present scheme of *Elementary Examinations*, by rendering it more adapted to the capacities of class pupils in Mechanics' Institutes, desirable.
3. The advantages of local prizes to successful candidates, at the Society of Arts Examinations, as a stimulus to local competition.
4. Whether any special inducements can be held out to lead soldiers to avail themselves of the Society's Examinations? [See the correspondence with H.R.H. the Commander-in-Chief of the Army, *Journal* p. 493.]
5. The propriety of adding to the Society's Examinations the subject of "Practical Gardening," in accordance with a proposal made to the Council by the Royal Horticultural Society, who have expressed their willingness to offer prizes in this subject.
6. How can Institutions promote the Physical Education of their members?
7. How may Popular Readings and Entertainments be made to promote the efficiency of Institution Classes?
8. The advantage of Garden Allotments, as a feature of the Institute, with a view of healthful recreation for the members.
9. Should Institutes promote the establishment of Horticultural Shows, Building Societies, Penny Savings Banks, and similar movements towards the social amelioration of the people?
10. The advantages and disadvantages of subscriptions to Institutes being paid by weekly or other small amounts.

The CHAIRMAN said it was now his duty to ask the Conference to enter upon the consideration of the various subjects which had been referred to in the report, and also those which had been suggested for discussion. Before the proceedings went any further he could not help expressing his regret that on account of ill health they were deprived of the presence of Mr. Chester, who had for so many years taken a most active part, and had been of the greatest possible service, in the system of Examinations which was now carried out by the Society. He also regretted that he should be obliged to ask their indulgence in allowing him to leave the chair before the business was concluded. He then called on the Secretary to state the alterations it was proposed to make in

THE PROGRAMME OF EXAMINATIONS, ELEMENTARY AND FINAL, FOR 1866.

The SECRETARY stated that, looking at the small number of candidates that in each year had taken up the subjects of Conic Sections, Navigation and Nautical Astronomy, Astronomy, and Agriculture,

it was proposed to omit these subject from the next year's Examinations. As regarded the Elementary Examinations it was proposed, with reference to the Junior Grade, that only one of the special subjects should be compulsory, instead of two as hitherto; and as regards females, that needlework alone should be compulsory. As regards the Senior Grade, the English History would this year include general English History, with special attention to the reign of George III. The Scripture Examinations would be in the facts of St. Matthew's Gospel. Liberty was given for the Boards to hold the Examinations at any time after 3 o'clock, instead of 4 o'clock as hitherto.

The Conference then proceeded to discuss

"The Establishment of Organising Teachers among the Institutes, on the Plan Adopted in the East Lancashire Union."

Mr. Lawton (Lancashire and Cheshire Union) said the system referred to was the employment of two gentlemen devoted entirely to the working of a district comprising about 12 Institutions. The district was divided between them, and they each visited a separate school every night in the week, taking charge of the classes, giving lessons, and taking the general supervision of the school for the evening. In addition to this, the organising teachers in East Lancashire held science certificates, and it was understood that wherever they visited for elementary work, science classes were always conducted by them after the elementary classes were finished, so that the Institutions in the district had the benefit of their assistance both for elementary and for scientific teaching. The plan was a very expensive one to work. It was certainly doing great service, but it pressed heavily on the Institutions that adopted it, inasmuch as they had to pay £15 a year for the services of the organising teachers, in addition to the expense incurred in providing their ordinary teaching power. The system sketched out for adoption in the course of next year in the Lancashire and Cheshire Union was a modification of this scheme. Instead of engaging gentlemen to devote themselves exclusively to the Union both day and night, it was proposed to distribute the Institutions into groups. There would perhaps be a group of five; one gentleman would take charge of special subjects at the central Institution on behalf of the district; the members of the different Institutions would attend the central Institution on the same terms as the members of the central Institution itself; the elementary work would be conducted by the teachers belonging to the several Institutions without a visit of a special teacher; and consequently, with a much less burden pressing upon them, the Institutions would be able to have elementary teaching, and a special teaching power at the central Institution at a much less cost than they would have to pay for the services of a visiting agent for one night.

Mr. Barnett Blake (Yorkshire Union) said that very great expense was certainly involved by the Institutions, because only a very small number could be served by one teacher. The matter had been brought under discussion when Sir James Kay Shuttleworth was present, and it was then considered most advisable, instead of attempting to do so little at so great a cost, to employ one agent for the whole district comprised within the Union, inasmuch as, though each Institution might not be so much benefited as by the system pursued in East Lancashire, yet the advantage really obtained would be spread over a much larger area. The resolution which he wished to propose on the subject was as follows:—

"That when ten or twelve Institutions sufficiently near will join in the employment of a competent teacher, to visit each Institution one evening in a fortnight, the instruction in evening classes may be well carried on with gratuitous aid; and that in districts where the Union of a larger number of Institutions is necessary to supply funds to obtain the assistance of an organising master, much advantage may be gained."

Mr. H. Cole, C.B., said he should be happy to second the resolution, for the purpose of discussing the question. The first part of it seemed to imply that the Institutions would rely upon gratuitous help for the greater part of their teaching, but would look to an organising teacher once a fortnight or so for the remainder. The principle of the resolution seemed to be that half a loaf was better than no bread, but that a whole one was better still. He (Mr. Cole) objected to reliance on gratuitous services, and wished to make an announcement as to some additional assistance which the Department with which he had the honour to be connected was disposed to afford in reference to certain subjects, and of which he hoped Mechanics' Institutions would avail themselves. A Minute of Council had recently been passed which enabled any Mechanics' Institution, or any Evening Class connected with a National or other kind of school, to have a drawing-class—which of course they could have without asking anybody's leave; but if they liked to establish such a class, and employ a certificated teacher in what was called the "second grade," which was a schoolmaster's certificate, or, if they preferred it, a teacher of the "third grade," they might then get paid for the work which they accomplished. There were no conditions as to the number of nights which the class need meet during the year; it was only a question of examination—similar to that conducted by the Society of Arts—once in a year. When a class required to be examined, they would have to work papers, which would be examined in London; and for every paper worked in the second grade, or in that grade of drawing, they might get ten shillings; so that if a clever artizan chose to learn a little geometry, and to do a little free-hand drawing, and drawing from a model, and in perspective, his teacher might demand from the department £2, or ten shillings for each paper. Further than that, if the Institution thought fit to employ a teacher having a third grade certificate, which was an art-teacher's qualification, and would unite with any local school of art, the nearest, or any other which might be preferred, and through the School of Art would send up papers of a higher grade than those performed in the presence of an examiner, and which would be judged of without reference to time, and solely with reference to quality, then they might obtain fifteen shillings for such work as was satisfactory, with the chance of competing for gold, silver, and bronze medals. This matter was one which touched both the teaching of night classes and the resolution under discussion. The minute had been laid before Parliament, and there was every reason to believe that it would come into operation during the coming year.

Mr. Blake said the object of the resolution which he had proposed was to encourage Local Unions to do more in practical teaching than they had hitherto done. Because they could not employ paid teachers it was thought there was no good to be done, whereas the fact was, that a great deal might be done by gratuitous teachers properly directed by an occasional visitor. Mr. Lawton would be able to testify that, in Lancashire, a great deal of good was done by the services of an occasional visitor.

Mr. Lawton did not consider it a healthy sign that they were asked to encourage a system of gratuitous teaching.

Mr. Blake said what he meant was that when they could only get gratuitous teachers they would do well to have a competent man to look after them—a system which was often adopted.

Mr. Lawton was quite willing to acknowledge the great benefit derived from voluntary teachers under paid teachers, but it was very necessary to remember that they ought in all their institutions to have paid teachers. He would give one instance from his own neighbourhood, as an illustration of a system which he thought would be found to work well. They had five institutions within a diameter of about two and a-half miles; he would suggest that those institutions should engage their own teachers

of elementary work, and they would be able to do that for thirty weeks in the year at a cost of £10, for which sum they could secure the services of a first-class man. He would then propose that they should have a special certificated teacher for special subjects at the central institution, at a cost of £12. Each institution would, under this scheme, have three class-nights under certificated teaching power, and one class-night under special teaching power.

Mr. C. Womersley (Hastings Mechanics' Institution) said the resolution merely served to affirm a principle about which no time need be wasted.

Mr. Cole said that if the resolution was supposed to mean that they recommended gratuitous teaching as a principle of action, he should have some objection to it. It was very well to get all they could for nothing, but everybody knew it was not likely to continue, and was not much prized after all. It was very important to make people who were being taught understand that what they were receiving was really something worth paying for, however moderate the charge might be. He did not like the use of the word "gratuitous," as it might be misunderstood, and he thought Mr. Blake could easily draw up a wider resolution which would embrace everything.

Mr. Sales (Metropolitan Association) thought it was a misnomer to call those mentioned in the resolution "organising teachers," because they not only had to set the machinery in operation, but they had to take part in working themselves. He should vote against any resolution which gave the authority of the Conference to the employment of gratuitous teachers. It was most desirable that the people attending the Institutions should feel bound to pay for the benefit they received from them, and not to trust to charity. He did not like to propose an amendment, but he hoped the resolution would not pass as it stood.

Dr. Pankhurst (Lancashire and Cheshire Union) said he thought they ought to embody in the resolution to be passed some substantive proposal, upon which they could fix the attention of the Conference. The substance of the resolution proposed by Mr. Blake was to assert that any system was better than none; but what they wanted to do was to show which out of the several systems submitted they believed to be the best. Mr. Lawton had very judiciously and effectually stated the points of difference between the plan which had received the sanction and approval of Sir James Kay Shuttleworth and the plan which was in partial operation in the Lancashire and Cheshire Union. The Lancashire system might be said to be the best for many obvious reasons. It was the simplest, the most economical, and the most productive of benefit, and these formed three very substantial reasons why it should be preferred. There were two subjects proposed to be taught, one of which might be termed general and the other special. The East Lancashire system gave to the same man both classes of work to do, while the Lancashire and Cheshire system gave to one set of men one subject, and reserved exclusively to the other set another subject. Mr. Lawton had stated the fact as to the money payments required by each Institution, and the same amount of work would be much better under the Lancashire than under the East Lancashire system; and for this reason, the object being that the special subjects should be taught in the best possible way, it seemed quite clear that each Institution should be pressed to supply its own staff of teachers for general subjects, and that the members of each Institute should be collected together under the management of a man who was devoted to one special class of teaching. He begged to move the following amendment to the resolution, as collecting together the principles of difference between the two systems:—

"That this Conference approves the system of organising teaching power through the Union by distributing Institutions into groups and a centre, at which special subjects may be taught, and suggests that each Institution should be pressed to establish a staff of teachers for general subjects."

Mr. Blake said the amendment was only his resolution put in another form, and he would at once withdraw his proposition.

Dr. Pankhurst said it was quite obvious that the number of special teachers they could command was very small compared with those who could be got to teach general subjects. The Lancashire and Cheshire had the advantage that while a special teacher was purveying instruction to one Union one night a week, and was so satisfying the wants of the Union, he might also be operating with the same efficiency for other Unions during the rest of the week, so that he might be purveying special instruction, of the best order and according to the most approved methods to five Unions in the same week, while at the same time a regular attention was paid to preliminary subjects, about which one might say that the higher they proposed to carry the point of special efficiency the broader still they ought to lay the basis of general subjects.

The Rev. R. Whittington (City of London College) seconded the amendment, and said that in the Institution he represented there was a fundamental rule that no teacher should be unpaid. He fully recognised the importance and the efficiency of paid teaching power, but on the other hand he knew there were many Institutions which were obliged to depend to a very great extent, especially in general subjects, on gratuitous teaching. He believed the system of organising teachers was one step in advance towards employing paid teaching exclusively, and he believed it was a system which would be productive of good results.

Mr. B. Rule (Aldershot and Farnham Board of Education) said he very much questioned whether it would be expedient on the part of the Conference to encourage the principle of gratuitous teaching.

The Rev. G. B. Macilwain (St. George's and St. James's, Westminster, Local Board) was fully sensible of the very great superiority of paid teachers over gratuitous teachers, but looking at the matter practically he thought they would all admit that for the present, at all events, they would be obliged to make very extensive use of gratuitous teaching. He found in his own Institution that they received very efficient aid from gratuitous teachers under the superintendence of paid teachers. He directed a great many classes, and in each room there was a paid teacher who was well skilled in the subjects being taught, and who had under him or her, as the case might be, ladies and gentlemen who were solely directed by the superintendence of the paid teacher, and to whom hints were given as to the way in which the teaching should be carried out. The system had been in operation for three or four years, and had worked well, the greatest harmony always existing between the parties engaged in it.

The Rev. W. S. Bruce (St. Margaret's and St. John's, Westminster, Local Board) having had great experience in connection with night schools and evening classes, wished to confirm what the last speaker had said. He fully admitted the usefulness of voluntary teachers, but he did not approve of schools where there were no paid teachers, because some one ought to be responsible for the general discipline and the tone of the education imparted. Still there were many cases in which it was absolutely necessary to employ voluntary teachers, and this was often the means of interesting parties in the school who would aid both pecuniarily and otherwise.

The Chairman said he did not think that by passing the resolution the Conference wished to discourage voluntary teaching, but only to declare that paid teaching was best. Whatever the Conference might say, however, it was a question which the various institutions would have to decide according to their individual circumstances.

Dr. Pankhurst's resolution was carried unanimously.

Sir F. R. Sandford then took the chair, and said the next subject was—

"Is any Modification of the Present Scheme of Elementary Examinations, by rendering it more adapted to the capacities of Class Pupils in Mechanics' Institutes, desirable?"

Mr. Barnett Blake said he supposed it would only be necessary for the Conference to affirm by a resolution the statement in the report on this subject. As many would be aware, the great difficulty hitherto had been that while in many Institutions there were a great number of candidates who were sufficiently advanced in reading, writing, and arithmetic to show that they had got so far the basis of instruction, the present system required that they should have passed in other subjects, namely, Gospel History, English History, and Geography. It had been found in the practical working of this that while there were many who stood in a very respectable position with regard to the former they had a difficulty as to the latter, and it had been thought that it would really be an encouraging step if the condition was so far lowered as to make one subject alone necessary for the junior candidates. He did not think it was at all necessary to interfere with the senior candidates, because if they professed to be seniors they ought to have more knowledge than the juniors. He would merely propose to do this by saying that it was desirable to reduce the standard required for certificates for the junior candidates, and for that purpose he would propose the following resolution:—

That it is desirable to grant certificates to such junior candidates as, having satisfactorily passed in reading and arithmetic shall also obtain a certain number of marks in one only of the subjects—Gospel History, English History, and Geography.

Mr. Rule much regretted that he was not at the Committee meeting yesterday at which this subject had been discussed, but he wished to suggest the introduction of another subject into the scheme of elementary education. He would suggest the very great advisability of introducing, both into the junior and the senior classes, English Grammar and Dictation. Many of the candidates were very well up in English History and Geography, but the general style of composition shown in the papers was very defective; and in many instances a large number of marks were lost by incorrect spelling. He believed that if English Grammar and Dictation were introduced it would materially improve the efficiency of the examinations; and in addition to that he would suggest that Composition should be introduced into the higher grade. He doubted very much whether any of the candidates who passed last year would be able to pass a satisfactory examination in English Composition, and he therefore wished the subject to be embraced, as well as Grammar and Spelling, in the examination.

The Chairman asked whether he would make it compuslory or voluntary.

Mr. Rule replied that he should prefer it to be compulsory.

Mr. Lawton had understood the decision come to by the Committee applied both to the higher and lower grade of candidates. He understood that what was then said applied to both grades.

The Chairman said he had understood that the decision of the Committee applied only to the junior grade.

Mr. Lawton said it should not be forgotten that many of the senior candidates were really the worst of the two. In fact, the seniors were those who had been neglected in years gone by, and the juniors were really the cleverest, they having but recently left school. With reference to females he had understood the scheme sketched out by the Committee to be that they would be required to take either Gospel History, English History, or Geography, but that they must be examined in reading, writing, arithmetic, and needlework.

Mr. Pearsall (London Mechanics' Institution) expressed a hope that all the candidates might be given clearly to understand what they were to be examined in, because it would be exceedingly annoying to them, when they had prepared for a certain examination, to find that more would be required of them than they had expected or were prepared for. In many cases the examiners rubbed up their own education to prepare the questions, which was unfair indeed to the candidates, who had not had equal advantage with the examiners. If the English language were taught on a better principle than that at present adopted it would be different, but on the system on which it was taught at present it was impossible that the candidate could be expected to pass a satisfactory examination in it.

Mr. Sales said it appeared that he had made a great mistake as to the decision come to yesterday by the Educational Committee, for he had quite understood, when voting for the resolution, that the reduction to one subject applied to both grades, or else he should certainly have opposed any resolution which did not apply to the higher grade. He spoke from his experience of a metropolitan district, where he found that the number of classes increased very considerably, and that those classes were well attended by the very persons whom they wished to get at. A man looked through the programme of the Society of Arts, and found that if he obtained a certificate from a District Union he need not pass another examination before undergoing the Final Examination of the Society; but when he looked to the requirement for the certificates he found that he was expected to have a smattering of English History and Geography, and he then asked why he should be expected to get himself up in those subjects when he only wished to undergo an examination by the Society in a subject in which he was engaged in his daily occupation, and with which English History and Geography had no connection whatever? This condition of requiring English History and Geography had greatly affected the elementary examination of the past year, and would do so still more in the future, and therefore, as a step in the right direction, he had voted yesterday that it should be made compulsory next year to take only one subject, and he hoped the time would come when it would not be thought necessary to make either English History or Geography compulsory on the candidate for examination. He hoped the system would be made something like the examination in honours, by allowing the candidate to take those subjects if he pleased. He was certain that if the Society of Arts continued to require English History and Geography in the Elementary Examinations, the District Unions would find that such a system was detrimental to the candidates themselves. He begged, therefore, to move, as an amendment:—

"That it is important that the Elementary Examinations should be more adapted to the capacities of class pupils in Mechanics' Institutions, by not rendering it compulsory in either grade to take up more than one of the three following subjects, viz.:—Geography, History, and Gospel History, in addition to Reading, Writing, and Arithmetic."

The Chairman said he had certainly understood yesterday that the resolution withdrawing one of the subjects for examination referred only to the junior grade, but he did not know whether Mr. Blake would have any objection to making his resolution applicable to both grades. He would, therefore, ask him whether he objected to leaving the word "junior" out of his resolution.

Mr. Blake thought no one could have misunderstood the decision of the Committee. He objected to the proposal that the alteration should apply to both grades. He disagreed with the reasons on which the proposal was made. It was one of the great crying sins of the day that in all the public questions which were being continually brought up people knew so little about history and geography, and why should they have certificates granted to them when all they knew might be a little reading or arithmetic? When the question was raised some time back as to the female candidates and the necessity for their passing an examination in plain needlework, the objection taken by some members was that they had

a right to consider the class for whom the examinations were established. He believed they would not be doing their duty if they neglected branches of education so necessary for the improvement of the people. The word "junior" in connection with the candidate did not apply to age at all, but only to attainments. If the candidates claimed a certificate of a higher grade, which supposed that they had acquired, at least, the elements of an English education, it was but fair to expect of them that they should learn something of the broad facts of history and geography. The plan which Mr. Rule had proposed would make the matter more difficult still, and there was really no necessity for it, because the quality of the composition could be judged from the answers given to the various questions. He did not believe there was a greater popular error than that of learning Grammar; and he did not believe that such a system as that proposed could be carried out successfully, though he admitted that there might be some good done by introducing Dictation. He did not consider that the necessity of having two subjects compulsory need be regarded in any way as a bar to the Local Boards returning candidates to the Final Examination of the Society of Arts, and he should therefore press the resolution which he had proposed.

Mr. Pearsall wished to state, from his own experience, what the state of matters was. At the present time there were young men who had entered themselves for the Society of Arts Examination in Arithmetic, but who had been rejected on the critical points of Dictation, Writing, and Grammar, and who were now answering questions on arithmetic in the public periodicals, though they could not obtain a certificate from the Society of Arts.

Mr. Lawton said he should like to reply to one or two things that had been said by Mr. Blake. He maintained that the Programme was not sufficiently distinct, but was too loose in its character, spreading over the whole of history as it did for the lower grade, and merely taking a period of fifty years for the higher grade. What he had stated before on this subject was that the modified scheme should bear entirely on the whole system of examination, including both the higher and the lower grades. He could also say that there many Institutions which would not adopt the present scheme of Elementary Examinations as the preliminary for the Final Examination. In fact, many of them had told him that if the present system continued they should take no notice at all of the Elementary Examinations, but take the matter entirely into their own hands, and conduct their own Previous Examination. Many of the candidates were willing to join for one special subject which they had been studying, it might be History or Geography, or Chemistry, but they would not go in for two. They could not do it, and not only that, they would not do it. If the Elementary Examinations only required Reading, Writing, and Arithmetic, allowing any other subjects to be optional, he believed the candidates would avail themselves of the examinations to a greater extent than they had hitherto done.

Dr. Pankhurst said he had looked with a great deal of care at the amendment proposed by Mr. Sales, and he felt bound to concur in it. The purpose they had in view was to state substantially what was to be the matriculation examination to the Final Examination of the Society of Arts. It was perfectly plain that the class from whom to exact a variety of subjects was the young people, and yet Mr. Blake was not disposed to do this, though he wanted to subject the labouring people, who ought to be exempt, to a severe test in subordinate matters. If a mechanic presented himself for examination it was quite obvious that they ought to expect as little from him as possible, considering that he was probably advanced in years, and had contracted certain mental habits which it would be difficult for him to overcome. He thought that from such a man they might fairly exact Reading, Writing, and Arithmetic, and one other subject which he should be required and expected to prepare himself in as a matter of intellectual culture. He felt satisfied that the amendment of Mr. Sales was one which would commend itself to the Society, and he had much pleasure in seconding it. It was very necessary to bear in mind that the preliminary examination was substantially a matriculation, and as they were approximating middle-class education to university education, so they also ought to approximate industrial education to middle-class education. He wished to impose on the instruction in every Mechanics' Institution all the conditions which were proper to an efficiently-conducted middle-class school.

Mr. Jones (South Staffordshire Association) said it seemed to be assumed that the Local Boards and District Unions must accept the senior certificates and then pass the candidate for the Final Examination. All the Society of Arts said was that they would accept such certificates, but the fact was that in many cases, if not in the majority, the Local Boards had their own special examinations. He could not see how it bore at all upon the question of Final Examinations, whether they had one or two subjects. It was just as unfair to ask a candidate coming up for examination in chemistry, or in a scientific subject, to take up one of the three subjects as it was to take up two, but in requiring the three, as proposed by Mr. Rule, they were really putting another condition for the admission to the final examination. The Society of Arts only required an examination in certain subjects which had been sketched out, and if they adopted a senior certificate the candidate had the option of being examined in any other subject besides the special subjects required by the Society, and the Local Boards were urged to encourage candidates to take the senior examinations because it would simplify the matter. It would be found very convenient in some Institutions to make the Previous Examination altogether independent of the senior examination. With respect to what had been done by the Committee, he quite understood that the senior programme was not to be changed at all, and if it had been intended to have been altered he should have spoken against it, because he was instructed by the Institution which he represented to press only for a change in the junior programme. It was of great importance that there should be some differences between the senior and junior programme, and he thought the Conference would only be doing its duty in approving the modification proposed by the Committee.

The Rev. W. S. Bruce did not believe that by keeping two subjects compulsory they would produce any higher state of education, because the greater the number of subjects a candidate was allowed or compelled to go in for, the more would he be likely to get only a smattering of each of them, while he would really know but very little about them. He had been examiner to one local board, and the atrocious answers that were given by the candidates in Gospel History, Geography, and English History were beyond what one could possibly have imagined could have been the case.

Mr. E. Hay Currie (Metropolitan Association) supported Mr. Sales's motion, though he did not agree with it *in toto*, but he believed it to be a step in the right direction. They had attained considerable results in the east of London during the past winter, but it was found that it was no use whatever trying to do anything with History and Geography. A large number of candidates wished to go in for the examination, but they asked what was the use of their being examined in History or in Geography. He quite agreed with what had been said about English Grammar. He believed that if the subject could be substituted for History and Geography, it would be a very great step in advance. He had had a class of about 50 or 60 lads, about 15 years of age, in English Grammar, and it was a very popular class indeed. There was a very strong competition at the end of the season, but the members positively declined going in for the other subjects.

Mr. Blake said he did not think it should be consi-

dered that the plan proposed was to be a pass to the higher examinations. What he wanted to do was rather to give an intermediate certificate, and this was a reason why it had been somewhat modified.

Mr. LAWTON said that in his district they were trying to do away with so many examinations being held.

Mr. RULE said they were not obliged to hold them.

Mr. LAWTON replied that they must have a test examination if they had not a preliminary one, or else how could they say that such and such a candidate had passed. They were trying as much as they could to amalgamate the Examinations, by doing away with some of the Local Preliminary Examinations.

Mr. SALES said, in reply to the chairman, he felt bound to press his amendment; English History and Geography, he considered were put quite out of court, because they were both on the papers of the Society of Arts, to the Final Examination of which it was intended to lead the candidate on.

The Rev. R. WHITTINGTON seconded the original resolution *pro forma*.

The amendment was then put and carried.

Mr. RULE then proposed his resolution as a separate motion:—

"That English Grammar and Writing from dictation be introduced into the Junior Grade, and that the same subjects, including Composition, be added to the Higher Grade, such subjects to be obligatory."

He said that some of the speakers seemed to think that English History and Geography were the only subjects by the study of which a young man could acquire mental discipline, forgetting that, in the way in which English Grammar was now taught—which was very different from what it used to be—nothing could be better for the purpose of mental discipline in those who studied it. It was now taught in a reasonable and philosophical manner, and the mental good to be gained by so studying it was far greater than that introduced by the study of English History and Geography—two subjects which could be very easily got up by students, whereas Grammar could not be, but must be thoroughly understood before a satisfactory examination could be passed. Mr. Blake had said that they could judge by the examination papers of the character of the candidates' composition, but he could assure Mr. Blake that he was very much mistaken about that. He had for several years revised the papers sent by the Society of Arts down to Aldershot for the Elementary Examinations, and he knew that those who replied to those papers were certainly not able to write a decent composition, in fact he very much doubted if three out of four of them could write a description of the town of Aldershot. It was a very sad thing that a young man should be entering life without being able to write a description of the town in which he lived, and he believed this matter was one of great importance. The matter of dictation, too, he thought, was a very important one. He did not mean by composition that they should require from a candidate an elaborate essay on Virtue, but a simple description of a town or a game, so that they might be able to judge of what power he had of expressing his thoughts.

Mr. SALES asked if Mr. Rule would make his resolution simply permissive instead of compulsory.

Mr. RULE said he was willing to do that, in the hope that at some future time it would be made obligatory.

The Rev. R. WHITTINGTON thought the Dictation ought not to be dropped, because it was a much better and more difficult thing than mere Spelling, as had been suggested, and had been adopted now in the public schools. Notwithstanding what had been said about Grammar, he believed that the subject, as it was now taught, was a most important one, and he quite agreed that it ought not to be ignored, though for the present it would perhaps be as well not to make it compulsory.

Mr. PEARSALL said it would perhaps answer the purpose if it was understood by the candidates that the examiners would append to the papers such remarks as they thought fit upon the Composition.

The CHAIRMAN asked if the gentlemen who were supporting the resolution had considered that it would involve a special night? If there were four subjects, and the candidates could take any two of them, they must have a separate night for each.

The Rev. W. S. BRUCE said that might easily be obviated. As the term "Dictation" had been objected to, he would suggest that it should be altered to "Writing from Dictation," and then no one could possibly make a mistake about it.

Mr. LAWTON thought that after the last resolution which had been passed it was hardly advisable to take in another subject, though he approved of Dictation, because it would not involve a separate night, nor any special preparation on the part of the candidates. He did not think it was desirable to introduce Grammar.

Mr. BLAKE strongly advised the Conference to reject the resolution, because if it was passed they would be virtually debarring the candidates from passing the examinations. It was clear enough that a candidate could not write an interesting description of the town of Aldershot if he could not answer a question in English History. Mr. Rule said that the replies to the papers were no test, and yet the very next minute he said that he had already tested the composition of the candidates by their papers. It was all very well to talk about Grammar, but the fact was that the best of our modern writers were those who had never learned Grammar at all. He protested against the introduction of Grammar and Composition, because it would keep the candidates from coming up to the examinations. Dictation he did not so much object to, but they might depend upon it that the more of these things they imposed on the candidates the more breaches of the regulation they would have. He was sure that nothing would be gained if the resolution were carried.

Mr. W. H. CURRIE had much pleasure in seconding the resolution.

Mr. SALES supported the resolution, and thought the remarks of Mr. Blake were utterly beside the question, inasmuch as it was not proposed to substitute English Grammar for one of the other subjects. He believed he should send far more candidates for examination in Grammar than in all the other subjects combined; and as the resolution was so very mild, seeing that it was only permissive, he hoped Mr. Blake would withdraw his opposition to it.

Mr. BROOKS (Banbury Mechanics' Institution) thought it might not be desirable to increase the number of subjects for examination, inasmuch as there would be great difficulty in getting examiners. He should be very glad to find English Grammar introduced, but he should be sorry if it had the effect of injuring the present examinations, or of preventing candidates coming forward. He was afraid that in many provincial towns this would be the case.

Dr. PANKHURST believed that consistently with the previous resolution it was highly undesirable to increase the number of subjects, and he thought that a great part of the good which it was thought would arise from introducing another special subject would be effected by informing the candidates, by a memorandum appended to the papers, that special attention would be paid by the examiners to Grammar and Spelling. He objected to the introduction of Grammar as a special subject, because it was so very vague. It by no means followed because a large number of candidates might be sent up that an useful examination would take place, because such an examination was exceedingly difficult. He hoped, therefore, that the Conference would not pass the resolution.

The CHAIRMAN said that in the Paddington Institution, with which he was connected, there was great difficulty in getting persons to superintend the examinations, and, therefore, he should be sorry to see the number of nights

added to. He should be sorry for Dictation to be introduced unless it were made obligatory on both classes of candidates. He quite agreed that Grammar was the most difficult subject which could be introduced, and it was one which was now disappearing from many of the public examinations.

The Rev. W. S. BRUCE suggested that the Chairman should ask the Society of Arts to strengthen the present programme by calling special attention to the subjects of Grammar, Spelling, and Composition.

The Rev. R. WHITTINGTON said the Society had already done all that they could in this matter.

The resolution was put to the meeting and lost.

Mr. G. F. WILSON, F.R.S., then took the chair, and announced as the next subject for discussion—

"THE ADVANTAGES OF LOCAL PRIZES TO SUCCESSFUL CANDIDATES, AT THE SOCIETY OF ARTS EXAMINATIONS, AS A STIMULUS TO LOCAL COMPETITION."

Mr. BLAKE said the resolution he should move on this subject was as follows:—

"That in all cases where the means for local prizes can be obtained it is desirable to offer them as a stimulus to local competition, to be decided by the result of the Elementary and Final Examinations of the Society of Arts."

He did not consider that it was at all necessary to enforce the great advantages of stimulating candidates in order to induce them to exert themselves so as to be as successful as possible. He believed there would not be the slightest difficulty in providing local prizes, but that there were many gentlemen who would be glad to subscribe funds for such a purpose. One very important part of the arrangement would be to see that the prizes were distributed by a thoroughly competent and impartial authority. The resolution merely affirmed the propriety and desirableness of establishing such a system of local prizes as had been found to work well in the Yorkshire Union.

Mr. BROOKS seconded the resolution. He said that their experience at Banbury had been decidedly in favour of granting local prizes to those who had obtained first-class certificates from the Society of Arts or from the Department at Kensington. This system acted as a great stimulus to local candidates, who were certainly deserving of some consideration on the part of those who lived in the town where the Institution was established, and were glad to receive such expressions of sympathy and of approbation. There was an idea in many places that the examinations of the Government Department and of the Society of Arts were rivals, but such was not the case, and at Banbury the starting of the Science School in connection with the Institution had been of great advantage to them, and it had been found that the two mutually assisted each other.

Mr. CRAIG (Glasgow Inststution) said that the Institution which he represented had a very strong feeling on this matter, and most earnestly wished the resolution to pass.

The Rev. R. WHITTINGTON could not understand to whom it was intended to give the local prizes, or how it could be a stimulus unless it were given to the second-best man, whose name was never known. The prize of the Society of Arts was stimulus enough to the successful candidate.

The Rev. W. S. BRUCE said the only way in which they could make the local prize a stimulus was by knowing which of their local candidates did the best.

Mr. BLAKE said the object was not to ascertain who the second-best man was, but to give a local prize to the local successful candidates.

Mr. SALES said the system now proposed was already carried out in connection with the Metropolitan Association, prizes being given to the successful London candidates, as shown by the number of marks awarded by the Examiners.

Mr. RULE said that for the first time this year Sir Charles Wentworth Dilke had given a prize of £5 to the candidate from the Aldershott Institute who obtained the highest aggregate number of marks at the Society of Arts examinations. Every first-class certificate was counted as four marks, every second as two, and every third as one. The same prize had also been promised for next year.

Mr. REYNOLDS (City of London College) said he was connected with three Institutions, and the plan adopted in one of them, the City of London College, was to have local examinations for the local prizes. He thought there would be some difficulty about the scheme as proposed, because they might get several members of one Institution who obtained precisely the same number of marks or certificates, and the question would be, which of them was entitled to the prize. This, perhaps, would not apply to small, but only to large Institutions, where it would be found a very hard matter indeed to arrange candidates in the order of merit, and he did not suppose that the Society of Arts examiner, considering the amount of work he had to do, would be willing to take the trouble of telling them in each case the number of marks gained by the candidates.

Mr. SALES said the Society of Arts supplied him with a list of candidates arranged according to their respective merits.

Mr. BLAKE said he did not believe that such a case as had been mentioned by Mr. Reynolds would ever arise.

The Rev. R. WHITTINGTON said, that surely one small Institution might send up two men who would take the same class of prize.

Mr. REYNOLDS said, that at the Polytechnic Institution they had more money to distribute in prizes than they could advantageously. In another Institution, at Bromley, there were two pupils this year who had first-class certificates for Arithmetic and Book-keeping, and he would ask Mr. Blake what he would do in such a case as that.

Mr. LE NEVE FOSTER (the Secretary) said it would perhaps save time if he stated at once that any Institution which desired the information could be furnished with the order of merit of its candidates.

Mr. BROOKS said that at Banbury every first-class certificate was supplemented by a local prize.

The resolution was carried.

"WHETHER ANY SPECIAL INDUCEMENTS CAN BE HELD OUT TO LEAD SOLDIERS TO AVAIL THEMSELVES OF THE SOCIETY'S EXAMINATIONS?"

Mr. SALES said he wished to move a resolution on this subject on the part of Mr. Chester. The matter had already been published in the *Journal*, and if the resolution was carried it would only be extending the area of the Society of Arts examinations, and add to the prestige and the work of the Society. The resolution he had to propose was as follows:—

"That the Conference welcome the sanction of His Royal Highness the Duke of Cambridge to the scheme of education carried on by the Society of Arts. In the opinion of the Conference, however, it is important that no inducement should even be suggested without previous consultation with the Commander-in-Chief or with the Military Council of Education. They also think that Local Boards at military stations should be cautioned not to take any initiatory measure without first engaging the concurrence at least of the general or other officer commanding, or, in the case of a regiment, of the officer commanding that regiment."

Mr. RULE had great pleasure in seconding the resolution. At Aldershot they had hailed with very great satisfaction the memorandum issued by the Commander-in-Chief, but at the same time they knew by experience that it was necessary to be extremely cautious as to the manner in which they proceeded in working among soldiers. If the plan were carefully and judiciously worked it would no doubt be a great advantage to the soldiers, but if not it would prove to be a very great disappointment to them-

selves and to the Society of Arts. The soldier knew only one master, and that was his commanding officer; he had no less sense of right, or moral feeling, or sensibility than the civilian, but his commanding officer was everything to him, and he would do nothing without his sanction, or unless he was ordered by him. Of course it was necessary that discipline should be maintained in the army, but some of the officers were remarkably strict, and many of them even went so far as to maintain that the soldier was "none the better for being educated." If they went to work incautiously they might depend upon it that the memorandum issued by the Commander-in-Chief would very soon be withdrawn, and nobody would know why. The only thing to do was to leave the whole matter to the local board, and to let them work it as their experience might tell them was best.

Mr. Womersley (Hastings Mechanics' Institution) knew nothing of the matter more than he had seen in a memorandum, but if it was such a difficult matter why should they interfere in it at all? He should certainly never ask an officer himself whether he might teach his men or not.

Mr. Pearsall said, that in the London Mechanics Institution they had had several instances of the willingness of soldiers to avail themselves of the advantages offered there; and several years ago some members of the Horse Brigade, stationed at Windsor, used to walk from Windsor to attend the evening classes, and march back after the classes were over.

Mr. Noldwritt (Walworth Institution) said he understood that the soldiers at Aldershot complained a great deal of the want of lectures.

The resolution was carried.

The Propriety of Adding to the Society's Examinations the Subject of "Practical Gardening," in accordance with a Proposal made to the Council by the Royal Horticultural Society, who have expressed their willingness to offer Prizes in this Subject.

The Chairman said that Mr. Chester took a great interest in this subject, and if he had been able would have been present to have spoken upon it. For his own part, he had lately been thrown a great deal into contact, as a member of the Fruit Committee of the Horticultural Society, with many of the practical gardeners in the country, and he could not help noticing how great a difference there was between those who were educated and those who were not. The Society of Arts were willing to do all they could to encourage education in gardening, and the resolution to be proposed would affirm the desirability of their so doing.

Mr. Rule proposed, and the Rev. R. Whittington seconded a resolution expressing the opinion of the Conference in favour of such a course, which was carried.

"How can Institutions promote the Physical Education of their Members?"

Mr. Blake proposed the following resolution:—

"That, in the opinion of this meeting, the physical education of the members of Institutions may be beneficially promoted by the formation of classes for the practice of cricket and other athletic exercises, excursions for the study of botany, geology, and cognate sciences, and similar pursuits adapted to summer time."

He thought that much good might be done in establishing games in connection with Institutions, especially during the summer months, when people wanted to get out of doors, and the Institutions and classes were generally neglected. It was not altogether a new thing, and was very effective in keeping the members together.

Mr. Sales heartily seconded the proposition. The Metropolitan Association which he represented had already taken the matter up, and though there were great difficulties in carrying out anything of the kind in a place like London, they had done all they could to overcome them. They had encouraged the exercise of athletic sports, and about twelve months ago they had a *fête* at the Crystal Palace, and though they did not expect to be very successful they were pleased to find that they attracted 13,600 visitors. They were shortly going to have another *fête* at the same place, when they would have a competition in athletic sports, to which they invited their friends from the country. Although they would only be able to give prizes to their own members, they were quite willing to form the nucleus of a fund for the purpose of providing a prize which should be open to the members of any Institutions to compete for.

Mr. Reynolds said the great difficulty in respect to this matter in London was the want of funds. The Institution doing most in this way was one at Bromley, where they had a cricket field for which they paid a high rental. For his own part he advocated an entire cessation from study during the summer, and he therefore advocated the establishment of some system for promoting the physical education of the members of the Institutions during the summer months.

The resolution was carried.

Mr. Jones said the next subject had been suggested by him, and was as follows:—

"How may Popular Readings and Entertainments be made to Promote the Efficiency of Institution Classes?"

All he wished to do was to ask the various representatives present whether they had found popular readings and entertainments promote the efficiency of the Institutions and the classes. He wished to get information on the subject.

The Rev. R. Whittington said this matter had always been a difficult one to carry out, but on the whole he was of opinion that popular readings and entertainments did promote the efficiency of Institutions, and for this reason it was very important that the members should feel that they had a kind of associated feeling in connection with the Institutions, and this could be done by giving them opportunities of inviting their friends to visit the Institutions on certain occasions. The benefit of elocution classes was sometimes doubted, but on the whole he thought they were of use, and it must be remembered that many of those who were members of the elocution class would not visit the Institution at all if no such class existed.

Mr. Blake said that in his experience he had found popular entertainments to be highly successful, even where class instruction was made an important feature of the Institution. After giving some results of popular entertainments in connection with the Institution at Huddersfield, Mr. Blake moved the following resolution:—

"That popular readings and intellectual entertainments may be made to promote the efficiency of institution classes by being given at fixed times, by being varied with the practice of music classes, and by brief discussions for the encouragement of English Composition on subjects bearing reference to the objects of the Institution."

Mr. Craig seconded the resolution.

Mr. Rule said that great attention ought to be paid to the subjects chosen for readings, and he thought that the people who carried out such readings often wanted advice on this subject.

Mr. Brooks thought the Society of Arts would be doing great service if they would publish a guide as to what works were suitable for public readings.

The resolution was carried.

"The Advantage of Garden Allotments as a feature of the Institute, with the view of Healthful Recreation for the Members."

Mr. Blake said in some districts it had been found that the plan worked well, and nothing could be more desir-

able than that it should be introduced generally wherever practicable, inasmuch as it would be greatly for the benefit of the members of the Institutions, and would also promote the study of botany. He would therefore propose—

"That, wherever practicable, it would be of advantage to the members for Institutes to provide garden allotments, under regulations, in which due cultivation and prompt payment of rent were prominent features."

Mr. Pearsall seconded the resolution, and bore testimoney to the efficient state in which he had found this system to be in in Yorkshire.

The Chairman said that within four miles of Birkenhead he had seen a piece of ground of about thirty acres let out in allotments on the plan proposed, and with the happiest results to the Institutions with which it was connected

The resolution was carried.

"Should Institues Promote the Establishment of Horticultural Shows, Building Socities, Penny Savings Banks, and similar Movements towards the Social Amelioration of the People?"

Mr. Blake proposed, and Mr. Winkworth seconded, the next resolution, which was carried as follows:—

"That Institutes may with great advantage promote the formation of Horticultural Shows, Building Societies, Penny Savings Banks, Provident Societies, and similar means of ameliorating the condition of working people, and also provide accommodation for the payment of wages."

"The Advantages and Disadvantages of Subscriptions to Institutes being paid by weekly or other small Amounts."

Mr. Noldwritt said the question of receiving the payments in small sums would depend greatly on the class of people who were the members of the Institutions, and it must be left entirely to each Institution to decide for itself.

Mr. Reynolds thought that, as a general rule, the payments ought to be made every three months at least, but there were circumstances, perhaps, in which shorter payments would be necessary.

Mr. Craig said that the Institutions which he represented were of opinion that wherever it was practicable the payments should only be made once a year.

Mr. Pearsall said it was a matter which must depend entirely on the locality in which the Institutions were placed.

The resolution was carried.

Mr. Blake then proposed, and Mr. F. Talbot seconded, the following resolution, which was passed unanimously:—

"That the delegates present at this Conference desire to express their high sense of the valuable services to Institutions rendered by the Society of Arts by the system of Elementary Examinations and the Certificates and Prizes at the Annual Final Examination, by which the important cause of adult education has been very greatly promoted, and they request the Council of the Society of Arts to accept their cordial thanks for the important aid which has thus been given to the Institutes in association."

Mr. Noldworth asked if the attention of the Society had been called to Mr. Lock's Theatre Bill, which, if carried, would oblige every lecture-room in the kingdom to be shut up as useless.

Mr. Le Neve Foster (Secretary) said it was no doubt a very important matter for the consideration of the Institutions, and he was glad it had been mentioned, but it was understood that for the present the Bill was withdrawn.

A vote of thanks to the three gentlemen who had presided over the Conference was then proposed by Mr. Rule, and seconded by Mr. Reynolds, and carried unanimously.

The Chairman returned thanks.

Fine Arts.

English Taste and Art.—M. Michel Chevalier, in a debate in the French Chamber on the 20th May, advocating increased exertions in France, said:—"It is now three years since I was in London, as a French member of the jury for the International Exhibition, I give the names of my honourable colleagues on that occasion—MM. Le Baron Gross, Merimée, and Dumas, who I see are now in their seats, and from whom I ask co-operation. The one fact more than another which particularly struck the French jury was the considerable progress made by foreigners in the art of design in connection with industry. We were struck by it; it inspired us with admiration for the efforts made by foreigners, but it likewise inspired us with a fear that our country might be out-done. We were impressed and frightened by the marked progress which the English had notably made in works of good taste. The English up to recent times, although they have had some celebrated artists, have not been very remarkable for taste; and good taste was wanting in their industry. The greater portion of designs used in the printed cotton manufactories at Manchester and Liverpool came from designers established in Paris. The English have understood that, during this industrial competition between the different foreign nations, it was necessary to make great efforts, and they have made them. A museum has been established at South Kensington for the purpose of educating teachers, who are afterwards sent throughout the manufacturing towns of the country; in propagating good taste a revolution has been effected. We were so much surprised at the progress made that when our report had to be drawn up, one of us (and he by no means the least competent in matters of taste, M. Merimée) treated this point specially, and certainly what he has written is one of the most curious and best written pages of the six volumes which comprise the general report of the French jury. From the three or four lines which I am going to quote to you, you yourselves will appreciate what the English have done, and will better understand the information laid before us, and the obligation under which we are, of redoubling our energies so as not to compromise our superiority. 'The school at South Kensington has been open for ten years. The corresponding provincial schools (and others which might have been added, to which masters have been sent) numbered ninety. The number of students trained throughout the United Kingdom was 91,386.' (M. Merimée—These numbers which were for 1862 must have now greatly increased.) M. Michel Chevalier continued—'With respect to the influence exercised in so short a period by this great institution, we admit freely the assistance rendered to us by our colleagues in the English jury. In answer to our question as to the cause to which the progresses so remarkable that year in their manufactures were attributed they replied, the new resources opened to industry by the schools at South Kensington.' I conclude by quoting that 'the study of drawing and of mathematics is the foundation of the instruction which should be given to the students.'"

Pompeii.—An interesting discovery has just been made at Pompeii, where the face of a large and handsome fountain has been uncovered. Connected with this a very curious fact is given, namely, that the upper portion of the fountain is covered with zinc, a metal which has not been supposed heretofore to have been applied to any such purpose. It is proposed to restore this fountain, which is decorated with shell work, in order to show the character of public works of the kind at the Pompeian period.

Commerce.

The Coal Mines of the World.—M. A. Burat, in a work entitled "Situation de l'Industrie Houillère en

1864," gives the following as the statistics of the extent of known coal fields and their annual production :—

	Extent in hectares (1 hectare being equal to 2·471 acres).	Tons.
British Isles	1,570,000	86,000,000
France	350,000	10,000,000
Belgium	150,000	10,000,000
Prussia and Saxony	300,000	12,000,000
Austria and Bohemia	120,000	2,500,000
Spain	150,000	400,000
North America	30,000,000	20,000,000
Total	32,640,000	140,900,000

As regards France, the coal basin of the Loire, which is only 25,000 hectares in extent, furnishes three-tenths of the whole of the coal raised in the country.

Colonies.

WATER CONSUMPTION IN MELBOURNE.—According to a statement made in Parliament the other day, the quantity of water consumed in Melbourne and the suburbs every twenty-four hours is 9,750,000 gallons, being at the rate of 90 gallons per head per diem, or a larger consumption per head than takes place in any other city in the world, save Rome, Marseilles, and New York.

ACCLIMATISATION IN VICTORIA.—At a recent meeting of the Acclimatisation Society, at Melbourne, a letter was read, bringing under the notice of the Council the eminent adaptability of the Bogong Mountains for the liberation of deer. The Bogongs are a range of mountains on the north-east of Victoria, consisting in many parts of basaltic plains, between 3,000 and 4,000 feet above the level of the sea. They extend from the river Murray to Gipp Land, run north by south-west, and abound with wild fastnesses, from which, if the deer were once established, it would be almost impossible to dislodge them. The letter concluded by saying that, "if this object be successfully achieved, next to the introduction of salmon nothing of such importance in the country will have been effected; a valuless tract of mountains, miles in extent, will become of use; deer-stalking, not inferior to any in Scotland, will be afforded, and an inducement to visit wild and romantic scenery in a cold climate will be offered." This letter it was decided to take into a fuller consideration at a future meeting. It is evident that a great number of deer must be enlarged at once to give any chance of the breed being fairly established in such a country; and with this object in view the secretary was requested to make inquiries as to the feasibility of importing a number of fallow deer from Tasmania.

Obituary.

EUGENE GERUZEZ, late Professor of Literature at the Sorbonne, and since Honorary Professor of the Faculty of Letters, died in Paris recently. M. Géruzez was a sound and prolific writer, and enjoyed a high reputation as a critic and literary historian. His best works are a "History of Political and Religious Eloquence in France in the 14th, 15th, and 16th centuries;" a "Complete Course of Education for Girls;" and the recently published "History of French Literature to the year 1789;" which last, if we are not mistaken, won for its distinguished author one of the great prizes of the French Academy. The funeral was attended by an immense number of literary men.

Notes.

COMMERCIAL EDUCATION IN FRANCE.—The Chamber of Commerce of Paris has recently established an institution that deserves attention, a school specially designed for youths intended for financial and commercial pursuits. Besides those branches of knowledge which are absolutely necessary for success in finance and commerce, the modern languages, English and German in particular receive special attention. The new school is in full operation, and was visited the other day by M. Duruy the Minister of Public Instruction, who is indefatigable in his endeavours to improve the means of public instruction. The establishment is on a grand scale and is situated in the Avenue Trudaine.

CAB!—In Paris, as in London, there are great complaints upon *fête* days, in bad weather, and at all times when public conveyances are in great requisition, that while the omnibuses exhibit a board bearing the word *complet* when they are full, there is nothing to tell whether a passing cab is engaged or not, and this affords the drivers the opportunity of being deaf to applications which do not quite coincide with their own views as regards direction, numbers, or otherwise. It is now proposed to remedy this by affixing to the cab a flat lamp, of a brilliant colour, so as to form a day as well as night signal, and so arranged as to be seen only when the vehicle contains no passengers.

NEW FORM OF HONOURING GENIUS.—The great French chemist, Thénard, was born in a village in the arrondissement of Nogent-sur-Seine, in the Aube, which was called La Louptière, on account of the immense number of wolves which formerly invested it. He was the son of a poor farmer, and was born on the 4th of May, 1777. Having studied chemistry under Fourcroy at the Jardin des Plantes in Paris, he eventually occupied the chair in the Academy of Sciences, rendered vacant by the death of his master, was created a baron by Louis XVIII., and died in 1857, crowned with all the honours that science had to bestow. His native village has applied for and obtained permission to honour his memory by appending his name to that of the place of his birth, which is for the future to be called La Louptière-Thénard. A grand *fête* was held there on the 21st of May to celebrate the event, when the new name was officially published.

SCIENTIFIC ASSOCIATION OF PARIS.—This new society, whose proceedings have been already noticed more than once in the columns of the *Journal*, has just made its first annual report. The subscription to the association is only ten francs a year, and the smallness of the rate has in this case produced highly satisfactory results. Besides defraying the expenses of a series of monthly meetings, and the cost of the experiments performed on those occasions, the association has been able to apply a sum equal to £840, in three equal amounts, to the encouragement of astronomy, physical science, and meteorology; this distribution of funds has already been noticed in ou columns. The portion devoted to astronomy is for the purpose of constructing a large telescope. A portion of the sum devoted to meteorology has been voted to several Dutch and French sailors for observations at sea, and valuable in the construction of storm charts, and in the elucidation of the laws which regulate such atmospheric phenomena. M. Terquem, of Metz, reported to the association, at its last meeting, the first results of his experiments, undertaken with the aid of the society, on the vibrations of metallic rods and plates. The Scientific Association of Paris consists at present of three thousand five hundred members, which, it is hoped, will be more than doubled next session.

MEETINGS FOR THE ENSUING WEEK.

MON. ...British Architects, 8.
TUES. ...Medical and Chirurgical, 8½.
Zoological, 8½.
Ethnological, 8. Captain Wilson, "Report on the Indian Tribes inhabiting the country in the vicinity of the 49th parallel of North Latitude."
R. Horticultural. 1. Mr. Jas. Bateman, F.R.S., "On Rafflesia Arnoldi." 2. Rev. M. J. Berkeley, "On Various New and Rare Plants."

WED....Society of Arts, 4. Annual General Meeting.
Royal Inst., 4. M. Jules Simon, "On the Physical and Moral Condition of Workmen in France." (In French.)
THURS...Royal Inst., 4. M. Jules Simon, "On the Physical and Moral Condition of Workmen in France." (In French.)
FRI.......Royal Inst., 4. M. Jules Simon, "On the Physical and Moral Condition of Workmen in France." (In French.)

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par.
Num. *Delivered on 26th May*, 1865.
214. Hong Kong—Correspondence.

SESSION 1863.
431 (c. 1). Poor Rates and Pauperism—Return (C).
Delivered on 27th and 29th May, 1865.
164. Bills—Inns of Court (as amended in Committee).
167. „ London Brokers.
168. „ Pier and Harbour Orders Confirmation (No. 2).
66 (VIII). Railway and Canal, &c., Bills—Ninth Report of General Committee.
285. East India (Home Accounts).
299. Patrick Donohoe and Edward Burke—Abstract Return.
302. Northern Circuit—Return.
303. Turnpike Trust (Devizes)—Return.
306. Post Fines—Return.
307. Armstrong Guns—Returns.
311. Police (Scotland) Seventh Report of Inspector.
388. Military Knights of Windsor—Return.

Delivered on 30th May, 1865.
166. Bills—Wick and Ayr Burghs Elections.
169. „ Inland Revenue.
172. „ Courts of Justice Buildings (Lords Amendment).
173. „ Courts of Justice Concentration (Site) (Lords Amendment).
174. „ Common Law Courts Fees (Lords Amendment).
175. „ Oxford University (Vinerian Foundation) (Lords Amendments).
313. Middlesex Industrial Schools Bill—Minutes of Evidence, &c.
320. Reformatory Ships—Return.

Patents.

From Commissioners of Patents Journal, June 16th.

GRANTS OF PROVISIONAL PROTECTION.

Annealing pots and saucers—1480—J. Hibell.
Artificial fuel—1438—H. Gibbs.
Artificial fuel—1547—D. Barker.
Atmospheric pressure, propulsion by—598—Sir J. S. Lillie.
Barège stuffs, manufacture of—440—W. E. Gedge.
Boots and shoes, manufacture of—1318—G. Haseltine.
Bottle stoppers—1466—W. Settle.
Brooms or brushes—1482—W. Martin.
Chaff-cutters—1501—F. Richmond, H. Chandler, & J. G. Richmond.
Chemical combustibles—477—W. E. Gedge.
Coal-tar colours, application to cotton and linen—1428—R. Maxwell.
Corks or bungs—1539—J. H. Johnson.
Dog leash—1476—S. Davis.
Embroidery—1432—W. Madders.
Extinguishing fire—1450—C. B. Spaeth.
Fabrics, washing raw materials employed in manufacture of—1464—J. A. Heinrich.
Fibres, machinery for sorting—1430—R. A. Brooman.
Fibrous materials, treating—1443—M. Henry.
Fibrous materials, spinning—A. and A. W. Pemberton.
Fibrous materials, combing and heckling—1557—W. Tongue.
Fire-arms and ordnance, breech-loading—1436—T. Wilson.
Fire-arms, breech loading—1525—A. Lancaster.
Foundry cupolas—1498—T. Summerson.
Furnaces—1064—W. Beardmore.
Furnaces, cupola—1448—R. Canham.
Furnaces for making welded iron tubes—1517—T. Pritchard.
Fuses of shells, igniting—1211—J. Blackie.
Gas meters—1370—W. R. Williams.
Gophering and pressing machine—1444—C. Cotton, F. Anderson, and D. Booker.
Hair-brushing machinery—1490—T. A. Browne and J. Knight.
Hammers, atmospheric forging—1380—E. A. Raymond.
Iron, &c., casting—1434—J. H. Johnson.
Japanned surfaces, ornamenting—1454—L. Brierly.
Keyless watches—1470—H. Son.
Lighting and heating—1507—W. Clark.
Locks—1402—W. E. Gedge.
Mail-catching apparatus—1362—A. Chavanne.
Measuring gas, &c., apparatus for—1458—R. A. Brooman.
Milk-pans—1545—C. H. Wansbrough.
Nickel and cobalt, production of from waste liquors of burnt copper ore—1352—W. Wright.
Oil, obtaining from fatty matters—1456—R. A. Brooman.
Oil-reservoirs—1549—R. A. Brooman.
Ordnance and fire arms, breech loading—1328—T. Craig.
Paddle-wheels—405—J. G. Tongue.
Paper manufacture—1486—R. H. Collyer.
Photo-electrotyping—1541—W. E. Newton.
Pile fabrics, manufacture of—1519—W. Gadd and J. Moore.
Piles, wooden, machinery for cutting off below water—1474—C. H. Murray.
Pocket lanterns—1513—W. E. Newton.
Railways, permanent way of—1511—T. Hunt.
Railway tyres, cast steel—1426—J. Firth.
Reaping and mowing machines—1503—W. J. Burgess.
Retorts—1424—J. A. Coffey.
Road scraper—1477—W. Smith.
Sawing machines—1452—C. Frazer.
Screw propellers—510—J. G. Hughes.
Shirts—1465—H. Tipper.
Stay or corset busk—1446—W. E. Gedge.
Steam boilers—1521—H. E. Newton.
Steam engine governors—1561—W. E. Newton.
Steel, manufacture of—1460—L. Moser.
Stillages—1329—T. Parkinson and W. Snodgrass.
Telegraphic communication on railways—1543—A. I. L. Gordon.
Textile fabrics, apparatus for stretching and drying—1360—J. Worrall and T. Hughes.
Tube-cutters—1527—Charles Taylor.
Umbrellas, &c.—1529—J. Stephenson.
Vices—1472—W. Johnson.
Wool, &c., washing—1500—J. Petrie.
Writing tables, &c., locking sets of drawers arranged in—1462—L. Diele.

INVENTION WITH COMPLETE SPECIFICATION FILED.

Flour, &c., apparatus for sifting—1568—G. Haseltine.
Sewing machines—1572—G. Haseltine.

PATENTS SEALED.

3142. W. Tate.	3171. J. Ramsbottom and T. Blackburn.
3145. C. W. Orford.	3176. J. Hargreaves.
3150. J. Butchart, H. Stroud, and S. A. Morrison.	3181. C. G. Wilson.
3151. E. T. Hughes.	3182. J. Byrne.
3152. H. J. H. King, H. E. Smith, J. B. Howell.	3190. W. E. Gedge.
3155. H. Druneau and P. Laidet.	3192. J. Bethell.
3164. H. A. de Briou.	3229. J. D. D. Morrison.
3166. J. Westwood.	749. G. Dibley and F. Braby.
3168. C. G. Hill.	1004. A. Homfray.
3170. F. Tolhausen.	1051. A. V. Newton.

From Commissioners of Patents Journal, June 20th.

PATENTS SEALED.

3167. C. E. Bryant and S. Middleton.	3195. R. A. Brooman.
3177. R. Wilson.	3198. J. Hay.
3179. J. and J. H. Fothergill.	3207. E. Morewood.
3185. J. Gillespie.	3208. C. H. Taylor.
3186. J. B. Edge and E. Hird.	3211. J. P. Robertson.
3193. J. F. Wheeler.	80. W. Clark.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1767. J. Lancelott.	1796. J. Kellow and H. Short.
1774. R. A. Brooman.	1799. J. Warren.
1798. J. H. Johnson.	1801. W. E. Newton.
1759. J. H. Glew.	1812. J. B. Wood.
1769. J. Sawyer & G. Padgham.	1825. A. Warner.
1779. J. F. Allan.	1845. G. Hazeltine.
1790. J. and T. A. Nield.	1990. E. Townsend.
1794. W. Clark.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1346. J. H. Johnson.	1388. R. and T. Winans.
1386. R. and T. Winans.	1389. R. and T. Winans.
1387. R. and T. Winans.	1414. S. Barlow.
1420. Sir J. Paxton.	1383. S. Hewitt.

Registered Designs.

Sanitary Zig-zag Urinal—May 25—4713—R. Willoughby, 39, Mildmay-road, Islington.
Bellows for Insect Powder—May 26—4714—M. Fitzgerald, 201, King's-road, Chelsea.
Hair Brush Apparatus—May 30—4715—S. E. Ravenscroft, White Rock place, Hastings.
A Clip or Binder—June 1—4716—4717—4718—George Twigg, Mosley-street, Birmingham.
An Improved Double-action Point Protected Pin—June 2—4719—C. Edkins, Camden-street, Birmingham.
Stud Button—June 3—4720—J. W. Scott, Victoria House, Worcester.
An Improved Hair Pin—June 3—4721—L. Hovenden, jun., 5, Great Marlborough street.
A Mechanical Chimney Sweeper—June 8—4722—R. Farr, Doncaster.
Government Cartridge Tester—June 15—4723—J. W. P. Field, 233, High Holborn.
Instrument or Apparatus for Lighting and Extinguishing Lamps—June 15th—2724—Satley Gas Works, near Birmingham.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, JUNE 30, 1865. [No. 658. VOL. XIII.

TABLE OF CONTENTS.

Proceedings of the Society.

Annual General Meeting.

The Annual General Meeting for receiving the Report from the Council, and the Treasurer's Statement of Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, was held, in accordance with the Bye-laws, on Wednesday, the 28th inst., at 4 p.m. WILLIAM HAWES, Esq., Chairman of the Council, presided.

The Secretary having read the notice convening the Meeting, the minutes of the last Annual General Meeting, and of the subsequent Special General Meeting, were read and signed.

The Chairman then nominated Mr. C. Stuart Barker and Mr. Purling as Scrutineers, and declared the ballot open.

The Secretary then read the

Annual Report of the Council.

The Council, as required by the bye-laws, now lay before the members at the Annual General Meeting the report of the proceedings of the past year.

Cantor Lectures.

These Lectures, which were tried with so much success last session, have been renewed in the present year. Three courses were selected, bearing on the objects of the Society, namely:—

"On the Reproduction of Natural Forms by Art and Manufacture." Five Lectures, by B. Waterhouse Hawkins, Esq., F.G.S., F.L.S.

"On the Application of Geology to the Arts and Manufactures." Six Lectures, by Professor D. T. Ansted, M.A., F.R.S.

"On the Application of Chemistry to the Arts and Manufactures." Six Lectures, by Dr. F. Crace Calvert, F.R.S. Abstracts of the first two courses of these lectures have already appeared in the Society's *Journal*, and full reports of Dr. Calvert's lectures, carefully revised by himself, will shortly be published.

The interest taken in these lectures has in no way diminished, as is abundantly testified by the increasing numbers attending them, even though it was found necessary to curtail the privilege of members to the admission of one friend instead of two, as was the case last year. While this interest continues to be maintained, the Council feel that they cannot do better than make arrangements for carrying on in the next session this branch of the Society's work. In the selection of the subjects and the lecturers it will be the endeavour of the Council to bring before the members of the Society information with regard to Arts and Manufactures which will tend to diffuse a love of Art, and promote a spirit of inquiry among those interested in the numerous industries of the country.

Medals and Prizes.

The success attendant on the offer of the Art-Workmanship Prizes of last year, induced the Council to renew the competition on a larger scale. Money prizes to the extent of upwards of £500 were offered for competition among the art-workmen of the kingdom, in eighteen different branches of manufacture, and in wood carving. The particulars have already appeared in the *Journal*. Eighty-seven different works were sent in in competition, and were exhibited in the Society's rooms for a few weeks at Christmas. The Council were fortunate enough to secure the services of Messrs. R. Redgrave, R.A., M. Digby Wyatt, and John Webb as adjudicators; and prizes to the extent of £274 were awarded to 37 competitors.

A large meeting of Art-workmen was held in the Society's rooms, by invitation from the Council, with the view of conferring with the workmen themselves upon the system of Art-workmanship competitions instituted by the Society, and receiving suggestions for carrying

them out more effectually. On this occasion it was stated that a larger number of competitors would have come forward had it not been that the workmen in all branches of manufactures had been unusually occupied in their various employments, and thus but little time was left at their own disposal to devote to these works after their hours of labour. At the meeting above alluded to there was strong and unanimous evidence afforded on all sides that the course the Society was pursuing was right, and the Council, acting upon that opinion, have this year renewed the competition on a still more extended scale; prizes are now offered to the amount of above £600, the articles to be sent in to the Society's house in December next.

Looking at the objects for which the various ancient Companies in the City of London were established, the Council thought it right to seek their co-operation in carrying out this scheme for the improvement of the Arts and Manufactures of the United Kingdom. The Worshipful Company of Salters at once placed an annual sum of £10 at the disposal of the Council to be applied in such way as they might think best for promoting the object in view; and the Worshipful Company of Plasterers within the last few days, with a desire to benefit the Art which they represent, have placed at the disposal of the Council one prize of £10, and a second prize of £5, for modelling, to be awarded by the Society under the same conditions as the other Art-workmanship Prizes. The Council have taken steps for making the competition known as widely as possible among workmen, not only in the metropolis but in the great centres of industry of the kingdom, such as Birmingham, Sheffield, the Potteries, &c. It is confidently expected that as the scheme becomes more generally known the response by competitors will increase from year to year, and that at Christmas next the members may expect to see a large number of works exhibited.

For the papers read during the Session medals have been respectively awarded to Mr. J. C. Morton, for his paper "On London Sewage, from an agricultural point of view;" to Mr. W. Stones, for his paper "On Colonisation, its aspects and results;" and to Professor John Coleman, for his paper "On Food for Cattle."

The Albert Gold Medal, founded as a memorial of His Royal Highness the late President of the Society, has been awarded to His Imperial Majesty the Emperor of the French for distinguished merit in promoting in many ways, by his personal exertions, the international progress of Arts, Manufactures, and Commerce, the proofs of which are afforded by his judicious patronage of Art, his enlightened commercial policy, and especially by the abolition of passports in favour of British subjects. His Royal Highness the President has himself communicated this decision to the Emperor, by whom it has been most graciously received.

Sir W. C. Trevelyan's Prize of £70 for a method of preserving meat, has not yet been awarded. This subject is one of great importance. It is attracting much attention at the present time, and a number of processes, founded on various scientific principles, are being practically put into operation. Some of them have been before the Society, and hold out promise of good results, but hitherto the specimens have not been subjected to a sufficiently lengthened test to warrant the prize being awarded in favour of any one process.

Dwellings for the Labouring Classes.

This subject, it will be remembered, occupied the attention of a Conference in May last year, invited by the Council to discuss it in all its bearings. That Conference lasted two days, was well attended, and after passing a series of resolutions embodying its views, recommended that the matter should be placed in the hands of a committee, who should endeavour to deal with it in a practical manner so far as was possible. Accordingly the Council, on the commencement of the past session, appointed a committee, presided over by the Chairman of the Council, and consisting of a number of gentlemen well known for the interest they have taken in the subject, and practically acquainted with it in all its bearings, both in town and country. This committee has held many meetings, all well attended, and has obtained much statistical and other information bearing on the question. They also visited, in company with Alderman Waterlow, the various improved dwellings which have of late been built, and are still building, in the metropolis. At their first meeting they divided their discussions into the following heads:—

1. The causes which appear to retard the erection of proper house accommodation, and the improvement of existing houses, for the working classes in town and country.
2. The operation of imperial and local taxation on such dwellings; and the expediency of relieving them from all or a portion of such taxation.
3. The effect of the law of settlement and removal of the poor upon such buildings in country districts.
4. The probable effect of extending the area of local taxation in town and country.
5. The operation of the laws relating to the transfer of real property in small plots, and the conveyance of chambers and *suites* of rooms.
6. The operation of the destruction of houses by railways and other local improvements.
7. The desirability of facilitating the conveyance of labourers to and from their works by railway.
8. Whether the provisions contained in the existing Acts of Parliament, for granting loans for the improvement of estates, might not be extended to the building of cottages, and if so under what special conditions.
9. Whether the provisions of the common lodging-

house act, and other statutes relating to the public health might not be advantageously extended.

10. Whether there are any other means by which the legislature can promote the object in view.

The Committee in May last presented their report. It appeared from reliable evidence brought before them that the great cause which retarded the erection of good and improved dwellings for the labouring classes was, that they were not commercially remunerative, and therefore would not attract capital to be expended on their construction, though they might pay a per centage on their outlay equal to the ordinary rate of interest on investments, and which might satisfy the philanthropist.

As regards the burdens which have been generally supposed to press heavily on this class of property, the Committee, after investigating the accounts of a considerable number of dwellings of this character found that the total amount of taxation from all sources does not exceed $1\frac{1}{2}$ per cent. on the whole capital invested, an amount which (even if the exemption from the whole of such taxation were practicable) is too small to exercise any appreciable influence on those contemplating the investment of capital in an undertaking of this nature. Under these circumstances, and considering the violation of sound principles involved in making any exemption in favour of any particular class of house property, the Committee did not feel justified in proposing the adoption of any measure of exemption.

The house duty may be usually avoided in blocks of buildings whose size would otherwise make them liable to it, by giving to each set of apartments a door opening to the external air, and making them thereby a distinct tenement.

The Committee recognise the importance of Union rating as affecting materially the erection of cottages in the country, as well as of Mr. Villiers' Act for enlarging the area of settlement. It did not appear that this question would have any material bearing on such dwellings in the metropolis. The law of real property, as affecting the purchase, sale, and transfer of property of this kind, was taken into consideration, and the Committee agreed in the expediency of greater facilities being given by law both for acquiring sites and for transfer from owner to owner. The Exchequer Loan Commissioners have power now, under the Enclosure Acts, to advance money under certain conditions to landowners for the building of cottages on estates in the country, but it does not appear that such loans can be made to aid in the erection of town dwellings, and the Committee are of opinion that facilities should be given for this being done. The demolition of dwellings by railways occupied the attention of the Committee, and they arrived at the conclusion that where public companies, under compulsory powers, destroy houses inhabited by the working classes, they ought to be compelled to provide sufficient improved dwellings within a convenient distance for the same classes in place of those destroyed, and should have special powers given them for that purpose; the Committee expressed their decided opinion that it would be for the benefit of the community at large that all the metropolitan railway companies should provide cheap means of transit, at convenient times, for labourers; but they hesitated to recommend that this should be made compulsory in all cases, believing that if their views of the results likely to arise from such accommodation to the working classes were correct, the directors of the railway companies would not fail to adopt them.

The importance of further powers being given to enforce sanitary regulations on the owners and inhabitants of this class of property was pointed out by the Committee, and they recommend that a concise analysis of the sanitary laws should be prepared, and that the defects of the existing enactments should be printed and circulated. In this way the attention of men of education and intelligence would be called to the subject, and they might be induced to take part in sanitary work in the neighbourhood in which they reside or carry on business.

The Committee conclude their report by making the following recommendations to the Council:—

1. That corporations, limited owners, &c., should have increased power to sell land for the erection of dwellings for labourers, under conditions as to proper drainage, ventilation, and sanitary regulations.

2. That the public loan commissioners should be authorised to lend money, at a rate not exceeding $3\frac{1}{2}$ per cent. per annum, for building dwellings for the labouring classes, under suitable guarantees and with due regard to sanitary arrangements.

3. That in all future railway acts, and acts for local improvements, when houses inhabited by the working classes are destroyed under compulsory powers, such companies should be compelled to provide, within a convenient distance, other dwellings in lieu of those destroyed.

That the following amendments should be made in our sanitary laws:—

a. That the appointment of inspectors of nuisances throughout the country should be compulsory.

b. That increased power be given to the proper local authorities, to oblige builders of houses to provide adequate drainage and ventilation.

c. That the medical officers of health should be irremovable without the consent of the Privy Council, and that the amount of their salaries should be subject to the approval of the same authority.

d. That houses in which lodgers are taken, especially where particular rooms in a house are overcrowded, should be brought under more efficient inspection.

5. That with the view of extending an accurate knowledge of the powers contained in the various acts relating to the removal of nuisances, the Council is recommended to prepare and publish a concise analysis of the existing law, calling the attention of the educated classes to this important subject, and pointing out how they may, merely by a little attention and exertion, confer most important benefits upon a large mass of working people and upon the country generally.

The Council are now taking steps for getting these recommendations carried into effect, and in reply to their application made to Her Majesty's Government have received a communication from the Lords of the Treasury that their lordships are willing and intend to apply to Parliament for power to enable them to grant loans of public money for the erection of dwellings for the labouring classes on condition that the public bodies undertaking their erection limit their rate of profit to £5 per cent., so as to distinguish their case from that of ordinary commercial enterprise. The details of the report have already been printed in the *Journal.*

Musical Education.

A committee has been appointed to consider the condition of musical education in this country and abroad, and His Royal Highness the President honoured the Committee by consenting to accept the chairmanship of it, and proposes to give the subject his attention when the evidence is laid before him. The committee has already held several sittings, and has taken the evidence of several eminent men in this branch of the Fine Arts. With the aid of the Government, through the agency of Her Majesty's Ministers in foreign countries, information of an extremely useful character has been received in reference to the musical establishments in the leading continental cities. It is intended to print this information, as well as the evidence given before the committee, in the *Journal.* The Council believe it will be of interest to the members, and have hopes that, through the influence of the Society, measures for promoting Musical Education may be adopted in this country as effective as those in Paris and other Continental cities.

Union of Institutions.

The Secretary's report, read to the Conference of representatives of Institutions held on the 14th inst., shows the position of this branch of the Society's operations. By this it appears that there is no diminution of candidates, the numbers attending the Examinations of the Society increasing from year to year.

Finance.

The accounts, showing the financial position of the Society, were published, as directed by the bye-laws, in the *Journal* of last week. By these it appears that the extraordinary liabilities at the close of the last year have all been discharged. Thus it will be seen that the heavy expenditure due to the renewal of the Society's lease, the alterations and repairs of the premises, and the publication of the Jury Reports, amounting to above £6,000, have been discharged out of the income of the Society, with the exception of £545 borrowed of the memorial fund, and the sale of stock to the value of £1,600; while the ordinary liabilities of the Society in current accounts remain as usual. The number of members continues steadily to increase.

The Treasurers' statement of receipts, payments, and expenditure for the year ending 31st May, 1865, as published in the *Journal* last week, was read by the Secretary.

The Chairman asked whether any member present required any further information, or wished to offer any observations either upon the accounts or on the general proceedings of the Society, on which

Mr. T. H. Hartley said, that early in the Session he called the attention of the Society to the subject of the scarcity of skilled labour in this country. The importance of that question was becoming more and more apparent from the great inconvenience which manufacturers were put to, and he thought it was a matter which should be discussed by the Society, and with that view he had sent a communication to the Society for the consideration of the Council. It was evident that unless some means were taken to a greater extent than had yet been done to train the youth of this country to skilled occupations, our manufacturers would be obliged to depend mainly upon foreigners. It was the case that in his own branch of business—the working of marble—he was obliged to depend a good deal upon foreign workmen, from the great scarcity of native skilled labour. At the same time there were great numbers of youths now confined in prisons and reformatories, who, if turned out from thence as skilled workmen, would be of great service to the state, instead of being a constant burden upon it. He was not aware of any society which was so well adapted to take up this question as the Society of Arts, being one cognate to its objects in the encouragement of arts and manufactures. The present state of the law with regard to apprentices was such as to discourage masters from taking them, and thus the great source of supply of skilled labour was, to a considerable extent, cut off. There was no other means of continuing that supply except by training the youth of the country, so as to replace the skilled workmen who died off. Another effect of the present state of things was that business suffered and wages were increased to an enormous extent. He always desired to see the workman well paid, but he had no douht that if things went on in their present course wages would soon rise to 10s. per day. He begged to press this subject upon the attention of the Council. The training of workmen was carried to the greatest extent on the Continent. In Denmark, Sweden, and Prussia, it was made compulsory that youths of a certain age should be apprenticed to some branch of skilled labour; and those countries were now manufacturing very largely avowedly for the supply of the English market. He was himself taking a large number of apprentices, notwithstanding the trouble this involved, and he had established a "home" for them, where as many were housed as the place would accommodate. He had also encouraged, as far as possible, the system of out-door apprenticeship, and he felt confident, if it were properly carried out on a larger scale, it would add greatly to the wealth of the nation in the supply of skilled labour applicable to the various branches of manufacture.

Mr. Henry Cole, C.B., said he believed he might say, on behalf of himself and his colleagues in the Council, that they would be happy to place an evening at Mr. Hartley's disposal next session for the reading of a paper on this subject if he would be good enough to prepare one, and he had no doubt the matter would then be fully discussed by the Society. The question of skilled labour was an important one, but for his own part he had no dread of workmen getting 10s. a day. With respect to

the Council's report, he hoped it would be considered satisfactory. It was not for the Council to speak in praise of themselves, but he felt that during the past year—thanks especially to the chairman who had acted during that period—they had brought forward one subject in particular of the highest importance to the welfare of this country. They lived in hopes that the legislature would do what lay in its power to enable the labouring classes of the kingdom to be properly housed. He thought the measure to enlarge the area of rating introduced by Mr. Villiers had a most important bearing upon this question, and he hoped this Society would not let the subject drop. One other point in the report he would also touch upon—that of Musical Education. He lived in great hopes that it would not be very long before England would be able to do for musical education what even the Neapolitans did, and what was done in Paris, Brussels, and in most of the large continental cities. This was a subject which it was hardly to be expected the House of Commons would very readily take up and grant a committee upon; the Council, therefore, thought it quite within the province of the Society to appoint a committee on the subject, regarding music, as indeed it had been regarded from time immemorial, as a most important branch of the fine arts. It was satisfactory to know that his Royal Highness the President took a personal interest in this question; and he (Mr. Cole) had no doubt some good would result from this discussion. He would now move that the report and statement of accounts now presented be received and adopted.

Mr. SEYMOUR TEULON had great pleasure in seconding the motion, and, in doing so, begged, as one of the auditors, to bear his testimony to the very admirable manner in which the accounts were kept by the Financial Officer.

Mr. SYMONS wished to know whether the new catalogue of the library had been completed, and, if so, whether it was intended to print it.

The SECRETARY replied that the manuscript copy had been completed for some time, and was available for the use of the members. It had not been thought advisable to go to the expense of printing it.

Mr. COLE quite agreed in the undesirableness of printing the catalogue, inasmuch as in any large library a printed catalogue, though perfect to-day, would be imperfect to-morrow. The fashion of printing catalogues of large libraries was now quite exploded.

Mr. SYMONS remarked that from a cursory view of the accounts it appeared to him that the Society was £1,000 out of pocket during the last year, which he thought would probably be accounted for by the exceptional items of the printing of the Jury Reports and the repairs of the building.

The CHAIRMAN explained that the two heavy items of the Jury Reports of the Exhibition of 1862, and the expenses incidental to the renewal of the lease, and the consequent repair of the premises (amounting to about £2,400) had been discharged without trenching upon the capital to the extent of more than £1,600, showing that, at any rate, they had been spending less than their income in their ordinary expenses.

The report was then unanimously adopted.

The ballot having remained open one hour, and the scrutineers having reported, the Chairman declared that the following members had been elected to fill the several offices. The names in *italics* are those of members who have not during the past year filled the offices to which they have been elected:—

COUNCIL.

PRESIDENT.

H.R.H. the Prince of Wales, K.G.

VICE-PRESIDENTS.

Sir Wm. G. Armstrong.
Thomas Baring, M.P.
Lord Berners.
W. H. Bodkin.
Sir J. P. Boileau, Bart.
The Earl of Caithness.
Harry Chester.
Henry Cole, C.B.
The Earl Granville, K.G., F.R.S.
Edward Hamilton.
William Hawes.
C. Wren Hoskyns.
Lord Henry Lennox, M.P.
Lord Lyttelton.
Right Hon. Sir John S. Pakington, Bart., M.P.
Sir Thomas Phillips, F.G.S.
The Marquis of Salisbury, K.G.
The Duke of Sutherland.
Thomas Twining.
Vice-Chancellor Sir William Page Wood, F.R.S.

COUNCIL.

Professor Bentley.
D. Roberton Blaine.
Stephen Cave, M.P.
John Bailey Denton.
Peter Graham.
Henry Maudslay.
Samuel Redgrave.
Rev. W. Rogers.
Sir Francis Sandford.
Col. Scott, R.E.
Geo. F. Wilson, F.R.S.
Thomas Winkworth.

TREASURERS.

W. B. Simpson. | *Seymour Teulon.*

AUDITORS.

H. Reader Lack. | *Philip Wright.*

SECRETARY.

Peter Le Neve Foster, M.A.

FINANCIAL OFFICER.

Samuel Thomas Davenport.

At the conclusion of the General Meeting a Special Meeting was held, when the following candidates were balloted for and duly elected members of the Society:—

Attwood, J., 61, Cannon-street, E.C.
Auld, Thomas Reid, 36, Portland-place, W.
Bruce, James, Inverquhomery, Longside, Aberdeenshire.
Crawford, Peachey Sowerby, 117, Lupus-street, S.W.
Graham, William F., Woodberry Down, Stoke Newington, N.
Green, Squire, 4, Shrewsbury-cottages, Holland-road, Brixton, S.
Hawkins, Henry, Wallingford, Berkshire.
Holroyd, Edward, Church-street, Wimbledon, S.W.
Miller, James Gordon, Financial Insurance Company, 60, King William-street, E.C.
Moseley, Walker, 17 and 18, King-street, Covent-garden, W.C.
Payne, Wyndham, 32, Kensington-square, W.
Roper-Curzon, Hon. Sidney, Grove House, Lower Tooting, S.
Scarell, Thomas, Beddgelert, Carnarvonshire.
Sims, Frederic John, Colemore-row, Birmingham.
Smith, Thomas Roger, 57, Strand, W.C.
Trotman, John, 42, Cornhill, E.C., and 31, Acacia-road, N.W.
Walmisley, John Richard Lambert, 5, Victoria-street, Westminster Abbey, S.W.
Webb, Capt. Sydney, 24, Manchester-square, W.
Westfield, George John, 5, King-street, Finsbury, E.C.

Mr. SEYMOUR TEULON said this being the last meeting of the Session he thought that, considering the very efficient manner in which the Chairman had discharged the laborious duties of his office, they ought not to separate without passing a cordial vote of thanks to that gentleman for his constant attention to the business of the Society, and for the ability and zeal with which he had presided on so many occasions over their meetings during the past year.

Mr. Barker had great pleasure in seconding the motion. For some months past he could himself bear testimony to the indefatigable manner in which Mr. Hawes had discharged his duties, not only in this room, but also in connection with the Committee on Labourers' Dwellings, of which he (Mr. Barker) was a member. They were greatly indebted to him for the time he had devoted to the interests of the Society, and for the manner in which he had discharged all the duties connected with his important position.

The motion was carried unanimously, and the Chairman acknowledged the compliment paid to him.

A vote of thanks to the scrutineers terminated the proceedings.

EXAMINATION PAPERS, 1865.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April last:—

ARITHMETIC.

THREE HOURS ALLOWED.

1. Find, by Practice, the value of $835\frac{9}{10}$ articles at £2 13s. 4d. each.

2. The price of iron is 16s. $7\frac{3}{4}$d. per cwt., find the cost of 24 tons, 15 cwt., 2 qrs., 14 lbs.

3. Find the sum, in integers, of £·3125, ·4375s., and ·75d.

4. If 2,240 stones, each 9 in. square, will pave a yard, how many stones will be required to pave a yard twice the size, each stone measuring 14 in. by 12?

5. Convert £540 17s. 6d. into decimal currency, £1 being the unit, and then find its simple interest for $3\frac{1}{2}$ years at 4 per cent. per annum, expressing the answer both in decimal and ordinary currency.

6. Goods were sold for £225 10s. with a gain of $12\frac{3}{4}$ per cent.; what would have been gained or lost per cent. by selling them for £187 10s.? Work by decimal currency.

7. A workman's wages are 1 flo. 3 cents, 4 mils a day, and his expenses are 12s. 6d. a week; what will his savings amount to at the end of a year in common money?

8. Exchange into English decimal coinage 12,687 francs, 50 centimes, the rate of exchange being 25 francs $32\frac{1}{2}$ centimes per pound sterling.

9. If a person whose income is £365 a year spend £8 16s. 3d. a week for the first 20 weeks, to what amount must he limit his daily expenditure for the remainder of the year so as to avoid being in debt at the end of it?

10. Find the insurance at 3 per cent. on a house worth £374, so that in case of fire the insurer may receive the value of the house and premium.

11. Transfer £1,500 of 3 per cent. stock at 90 to the 4 per cents. at 75, and find the difference in the annual income.

12. A merchant bought 24 cwt. of sugar at $5\frac{1}{2}$d. per lb., and sold $\frac{1}{8}$ of it at $6\frac{1}{2}$d., $\frac{1}{4}$ of it at 6d., and the remainder at $5\frac{1}{2}$d. per lb., what is his gain per cent.?

13. A tradesman marks his goods with two prices, one for ready money and the other for a year's credit, allowing discount at 5 per cent.; if the credit price is £2 9s., what ought the cash price to be?

14. A has goods worth 30s. which he barters with B at 45s., allowing him 9 months' credit; B rates his exchange at 20s., giving six months' credit. What is the value of B's goods?

15. At a game of skill A can give B 10 points out of 50, and B can give C 10 points out of 50. How many points can A afford to give C out of 50?

16. If oranges can be bought at the rate of 20 a shilling, how many should be sold for £1 8s. to gain 40 per cent.?

17. A, B, and C are partners, A receiving $\frac{2}{5}$ of the profits, B and C sharing the remainder equally. A's income is increased £220 when the profits rise from 8 to 10 per cent. Find the respective capitals invested.

18. A merchant purchases wheat at 71s. 6d. a quarter; at what must he sell it to gain $12\frac{1}{2}$ per cent. and allow a purchaser $2\frac{1}{2}$ per cent. discount?

19. What half-yearly dividend is due upon an investment of £2,500 in the Three per Cents at $87\frac{5}{8}$ after deducting 7d. in the pound for income-tax?

20. If 15 men be necessary to excavate 966 cubic yards in 8 days, working $10\frac{1}{2}$ hours daily, how many men would be required to excavate 575 cubic yards in 12 days, working $7\frac{1}{2}$ hours daily, 4 extra men being taken on during the last 4 days?

BOOK-KEEPING BY DOUBLE ENTRY.

THREE HOURS ALLOWED.

1. In what does the difference between single entry and double entry consist, and what is the special advantage possessed by the double entry method?

2. What is the distinctive use of the "Journal" in the Italian system of book-keeping by double entry?

3. What should a profit and loss account exhibit?

4. What should a balance sheet exhibit?

5. Journalize and post in proper technical form and language, the following imaginary facts and transactions, and make out from the ledger, a trial balance, a profit and loss account, and a balance-sheet.

John Long and James Rose begin business in partnership on the 1st January, 1865.

John Long's capital was £2,000 in cash, and James Rose's capital £1,500 in cash and £1,000 in wine.

N.B.—The capital and drawings of the partners are subject to interest at 5 per cent. per annum, and the balance of the profit and loss account is divisible thus:—To John Long *one-third*, to James Rose *two-thirds*.

1865.

Jan. 3.	Bought of Tom Styles, wine, duty paid	£450	0	0
,,	Accepted Tom Styles draft @ two months date	450	0	0
5.	Lent John Nokes cash	300	0	0
7.	Sold to W. Box, wine	800	0	0
,,	Sold to H. Potts, wine	250	0	0
,,	Received of W. Box, cash on account	600	0	0
8.	Sold to S. Vix, wine	120	0	0
,,	Paid cash for office furniture and fixtures	105	0	0
9.	Received of W. Box, his acceptance @ six months	205	0	0
,,	Charge W. Box with interest, six months, on £200	5	0	0
12.	Shipped on own account and risk to Bombay, wine invoiced at	330	0	0
13.	Bought wine of J. Styles	700	0	0
,,	Paid cash to J. Styles on account	500	0	0
15.	Cash drawn out by James Rose	400	0	0
,,	Do. do. by John Long	100	0	0
,,	Bought of C. Aggs, wine	830	0	0
16.	Received cash, advance on the above shipment to Bombay	140	0	0
,,	Bought wine for ready money, and paid cash	1,150	0	0
,,	Accepted C. Aggs draft at three months date	500	0	0
Jan. 18.	Sold wine to J. Nokes	£625	0	0
,,	Charge interest to J. Nokes	7	10	0
,,	Received of J. Nokes his acceptance on account	732	10	0
,,	Advanced for petty cash	20	0	0
20.	Sold wine to J. Nokes	270	0	0
,,	,, ,, J. Dodd	860	0	0
23.	,, ,, R. Kell	400	0	0
,,	Paid trade charges out of petty cash	8	6	

24.	Bought wine of N. Scott	125	0	0
26.	Received of J. Nokes his acceptances	100	0	0
,,	,, S. Dodd ,, ...	300	0	0
28.	Discounted with O. G. & Co. J. Nokes' acceptance for	732	10	0
,,	Received cash of O. G. & Co.	705	5	0
,,	Discount charged by O. G. & Co. ...	27	5	0
30.	Paid to N. Scott, W. Box's acceptance	205	0	0
31.	Stock of wine on hand at cost	950	0	0
,,	Interest on amount drawn out by John Long	0	3	4
,,	Interest on John Long's capital	8	6	6
,,	Interest on amount drawn out by James Rose	0	13	4
,,	Interest on James Rose's capital......	10	8	4
,,	Rent due to A. Bone	18	10	0
,,	Salary due to T. Fox	25	0	0
,,	Trade charges paid out of petty cash	9	3	0

ALGEBRA.

THREE HOURS ALLOWED.

A.

1. If n is any integer, show that $x^n - a^n$ will divide out by $x-a$, and find the value of the quotient.

2. If $A_n - A_{n-1} + A_{n-2} + - - - - + A_1 + A_0 = 0$ prove that $A_n x^n + A_{n-1} x^{n-1} + - - - + A_1 x + A_0$ contains the factor $x-a$.

3. Find the value of the continued product of $a+b+c$; $a+b-c$; $a-b+c$; $a-b-c$; and account for the result remaining unchanged when any two letters in it are interchanged, and also for it containing no odd power of a, b, or c.

4. Reduce the fraction $\dfrac{\dfrac{a+b}{c+d}+\dfrac{a-b}{c-d}}{\dfrac{a+b}{c-d}+\dfrac{a-b}{c+d}}$ to its simplest form.

5. The provisions of a fort ran out in 30 weeks; it was originally victualled for 60 weeks, but at the end of eight weeks its strength was doubled, and six weeks later 750, fresh men were thrown in. How many men were in the fort at first?

6. Find the square of $\sqrt{1+c}+\sqrt{1-c}$ and extract the square root of $1-(1-c^2)^{-\frac{1}{2}}$.

7. If $a+b$, $a+c$, $b+c$, are in harmonic progression, show that a^2, b^2, c^2 are in arithmetical progression.

8. Solve the equations $\left\{\begin{array}{l}\dfrac{x^2}{y}+\dfrac{y^2}{x}=18\\ x+y=12\end{array}\right\}$

B.

9. Express 1865 in the ternary scale of notation. Also in a scale employing only the symbols of zero and plus or minus unity (denoted by 1, $\overline{1}$ respectively), express the value of 50.

10. Extract the cube root of 990 in ascending powers of $\frac{1}{100}$ by the binomial theorem, and apply your result to find its value to seven places of decimals.

11. Five sets of three-volumed novels are arranged along a book-shelf; in how many different ways can they be *intermixed*, taking care that the second volume of any one set is always to be found between the first and last volumes of the same set.

GEOMETRY.

THREE HOURS ALLOWED.

To obtain a First-class Certificate, at least six problems and four propositions must be correctly done; to obtain a Second-class, at least four problems and eight propositions.

1. All the angles made by any number of lines meeting in one point are together equal to four right angles.

2. If two triangles have two sides of the one equal to two sides of the other, each to each, but the angle contained by the two sides of one of them greater than the angle contained by the two sides equal to them of the other, the base of that which has the greater angle shall be greater than the base of the other.

3. Describe a parallelogram that shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

4. If a straight line be bisected and produced to any point, the rectangle contained by the whole line thus produced, and the part of it produced, together with the square on half the line bisected, is equal to the square on the straight line which is made up of the half and the part produced.

5. Draw a straight line from a given point either without or in the circumference, which shall touch a given circle.

6. In a circle the angle in a semi-circle is a right angle; and the angle in a segment, greater than a semicircle, is less than a right angle; and the angle in a segment less than a semi-circle is greater than a right angle.

7. Describe a circle about a given square.

8. If the sides of two triangles about each of their angles be proportionals, the triangles shall be equiangular to one another, and shall have those angles equal which are opposite to the homologous sides.

9. Similar polygons may be divided into the same number of similar triangles, having the same ratio to one another that the polygons have.

10. If the vertical angle of a triangle be bisected by a straight line which also cuts the base, the rectangle contained by the sides of the triangle is equal to the rectangle contained by the segments of the base together with the square of the line which bisects the angle.

11. If two straight lines be at right angles to the same plane they shall be parallel to one another.

12. If two parallel planes be cut by another plane their common sections with it are parallel.

PROBLEMS.

1. Construct a right-angled triangle, having given the perimeter and one angle.

2. Bisect a given quadrilateral by a straight line drawn through a given angular point.

3. In any quadrilateral the squares on the diagonals are together equal to twice the sum of the squares on the straight lines joining the middle points of opposite sides.

4. Circles are drawn touching a fixed straight line at a fixed point; show that the tangents at the points where they cut a parallel fixed line, all touch a fixed circle.

5. Given one angle of a triangle, the side opposite to it, and the sum of the other two sides—construct the triangle.

6. Divide a given arc of a circle into two parts, so that the chords of these parts shall be to each other in a given ratio.

7. Trisect a given triangle by lines drawn from a given point in one of its sides.

8. Describe a circle which shall touch a given straight line at a given point, and bisect the circumference of a given circle.

9. Point out how, with a card and pair of scissors, ocular proof may be given of any of these propositions:—

(1) The angles of a triangle are together equal to two right angles.
(2) Parallelograms upon the same base, and between the same parallels, are equal to one another.
(3) The squares on the sides containing the right angle of a right-angled triangle are equal to the square on the other side.
(4) If a straight line be divided into two equal and also into unequal parts, the squares on

the two unequal parts are together double of the square on half the line, and of the square on the line between the points of section.

(*To be continued.*)

MUSICAL EDUCATION.

In a recent number of the *Journal of the Musical Union*, Mr. Ella makes the following remarks:—

We would strongly recommend an hour's perusal of a very small volume by Fétis, entitled *Musique mise à la portée de tout le monde*, in which he would find that music is more distinctly both an art and a science, than any other of the fine arts. We have once read, in an English print, that music is not a science! England is the country of liberty, where persons may talk and anonymously write any amount of nonsense; but in France, Germany, or Italy, the arts are better understood, and people are not so easily gulled on such matters.

We earnestly hope that the results of the present committee (the Society of Arts Committee), composed entirely of amateurs, unbiassed by professional interests, will be more successful, and lead to some practical benefit to music and musicians. In no country are musical publications, classical works of the great masters—sacred and secular, instrumental and vocal—*so cheap* as in England, and in no other country is good musical instruction *so dear!* A modern edition of the Messiah, the whole of Beethoven's and Mozart's Sonatas, Mendelssohn's Songs without Words, Bishop's Glees, and a thick volume of hymns and chorales cost less money than a couple of pianoforte lessons by a first-rate master! In fact, there are lessons given in London at high prices, by second and third rate pianists, who, in Vienna, Milan, Stutgard, Berlin, Brussels, Munich, and Paris, would be extremely fortunate to obtain half the lowest amount demanded. What is wanted to meet the increasing appetite for good music and for the instruction of youths whose parents are unable to afford them a *complete* education, is a national academy, with government aid, presided over by an experienced professor of independent means and moral influence, on whose judgment reliance can be placed for the appointment of competent masters in each department. Such a man is be found in London. Genius belongs exclusively to no country, but talent may be obtained by educating those who are endowed with a natural disposition for music; and we ardently hope that the learned and artistically sympathetic Chancellor of the Exchequer will be able to spare a little of the four millions surplus in aid of the cause of music. A national academy, with one thousand students, well educated, would supply us with competent organists, excellent vocalists, and efficient orchestral and military musicians. As the London mechanic justly observed at the recent meeting in the South Kensington Museum, the competition of foreign schools of gratuitous instruction beats us out of the field. Cold temperaments are found in every country, which neither education nor practice can mould into artistic shape; but a country that has produced poets and dramatists, *nulli secundos*, can assuredly produce musicians? Precocious talents abound in this country, and the reason that these young musicians fail to realise in manhood what they promised in childhood, is simply owing to the want of a cheap and complete education under competent masters, with access to libraries and good practical exhibitions of the art.

What is meant by a complete education includes a knowledge of harmony, counterpoint, composition, instrumentation, musical history, structure and nature of instruments, and the elements of acoustics, requiring, at least, six years studious application. To these acquirements might also be added an acquaintance with modern languages—Italian, French, and German.

ON THE ACTION OF SILICATE AND CARBONATE OF SODA ON COTTON FIBRE.

By F. Crace Calvert, F.R.S., F.C.S.

I have lately been engaged in investigating a case of injury to goods, which I hope will prove interesting to chemists and manufacturers, from the novelty of the ascertained chemical facts to which the injury is traceable.

A large quantity of blue dipped indigo cotton goods, with white reserves, were shipped two or three years ago to South Africa, and when opened, some time after their arrival, were found so unsound as to be quite unsaleable, the cotton fibres being so much injured as to give way upon the slightest strain. The goods were, therefore, returned to this country, and placed in my hands to investigate the cause which had produced this damage.

As a large number of bales were returned without having been opened abroad, an excellent opportunity offered itself for selecting a well-defined series of pieces for experiments, and also for judging of the effects of packing on goods generally, when exposed for a long period to the hot and moist atmosphere of tropical climates.

Firstly, on opening the bales, I observed that the boiled-oil cloth which had been employed to protect the goods from external damp, yielded when subjected to a very slight strain, proving that the texture of the cotton fibre had been injured by the oxidation it had undergone, in consequence of its having been saturated with boiled oil.

Secondly, on examining the goods forming the bales, it was found, in every instance, that the outer folds, including the second, and sometimes the third, were stained and dirty, but this did not extend deeper, the inner folds being perfectly free from stain or mildew. These facts show the importance of returning to this country (where claims are intended to be made upon the manufacturers or packers), entire and unopened bales of goods, instead of a few sample pieces, which cannot show the state of the bales, and enable the examiner to speak with certainty as to the cause of injury.

I also ascertained that the rottenness of the fabrics could not have been caused by their having been packed in a damp condition, for the hygrometric moisture of a piece in the centre of a bale did not exceed 8·5 per cent. Further, the goods were carefully examined to ascertain if any mildew could be discovered, which would have occurred if the goods had been packed in a damp state, and which would certainly have developed itself more fully in the interior of the bales than nearer the outside, if damp packing had been the cause. What completely removed from my mind all doubt as to the cause, was that, on carefully examining the pieces composing the bales, I found among the injured pieces, some which were quite sound, and on submitting these pieces to analysis, comparatively with those which were injured, the following results were obtained:—

The sound pieces left only from 0·55 to 0·65 of ash, whilst the injured pieces left 8·29 and 8·59 of ash, the composition of which was as follows:—

	No. 1.	No. 2.
Insoluble silica	2·94	3·81
Silica combined with soda	2·35	2·53
Soda	1·77	1·60
Other salts: Sulphate of soda, Chloride of sodium, Sulphate of lead, &c.	1·23	0·65
	8·29	8·59

These analyses show that the pieces had been finished with silicate of soda, which had undergone a partial decomposition; while the pieces which left only a few thousandths of ash were found, on further examination, to have been finished in the ordinary way, viz., with amylaceous substances. This induced me to examine more minutely the goods, to ascertain whether it was to the silicate of soda, or to the carbonate of soda, arising

out of its decomposition, that the injury sustained was due; and I was further prompted to carry on this investigation from the fact that at the present time the tendency amongst manufacturers is to weight their goods. It is well known that the risk of mildew is considerably increased in proportion to the weight of size; consequently there is a great inducement to use mineral in preference to vegetable substances for that purpose. I, therefore, trust that the results now published will warn manufacturers of the risk they run in using mineral size without great care and experience. Whilst on this point I may be permitted to give here an insight into the nature of the size often used in Lancashire for sizing the warps of grey calicoes, and, therefore, I give a few of the results obtained at my laboratory.

Analyses of Various Cloths.

No. 1.

Mineral matter, principally clay and sulphate of magnesia	5·2
Water in excess	2·8
Fermented flour	10·0
Hygrometric moisture	8·0
Fibre	74·0
	100·0

No. 2.

Mineral matter, principally sulphates of baryta and magnesia	4·5
Water in excess	2·1
Fermented flour	11·3
Hygrometric moisture	8·0
Fibre	74·1
	100·0

No. 3.

Mineral matter, principally sulphate of soda and clay	4·8
Flour	10·0
Water in excess	4·5
Hygrometric moisture	8·0
Fibre	72·7
	100·0

No. 4.

Mineral matter	1·24
Water in excess	1·74
Fermented flour	13·02
Hygrometric moisture	8·00
Fibre	76·00
	100·00

The above data show that warps are sized with sour flour (viz., flour which has been allowed to ferment for several days or weeks) and various mineral matters, to the amount, irrespective of moisture, of about 15 per cent. There can be no doubt that goods thus sized are extremely liable to mildew, owing on the one hand to the use of fermented flour, or organic matter, in a state of decay, and on the other to the use of clay, which tenaciously retains moisture, and facilitates cryptogamic vegetation when the goods are packed. I may state, *en passant*, that sulphate of magnesia, sulphate of lime, sulphate of baryta, sulphate of soda, and the chlorides of sodium and magnesium are often used, with or without clay, as weighting materials.

On examining the comparative strength of various pieces composing a bale, I observed that the outside folds of the pieces which formed the external parts of the bale (above alluded to as dirty and stained) were comparatively strong when tested against the folds of the same piece which were towards the interior of the bale. I therefore took the same weight of cloth from both classes of folds and submitted them to analysis, with the following results:—

	Interior of bale.	Exterior of bale.
Insoluble silica	4·81	7·08
Silica combined with soda	2·53	0·20
Soda	1·60	0·47
Other salts	0·65	0·55
	8·59	8·30

On examining and comparing these figures, it is at once seen that the stained fold shows a large increase in the amount of insoluble silica, and a corresponding decrease in the amount of silica combined with soda; but, notwithstanding this, the total amount of silica is nearly the same in both classes of cloths. Further, that there is a total disappearance in the stained fold, of 1·13 per cent., or more than two-thirds of the total amount of soda. From these results it would appear that the silicate of soda, when first applied to the goods, contained the whole of its silica in combination with the soda, and that under the influence of the carbonic acid of the atmosphere, the silicate of soda has been decomposed into insoluble silica and carbonate of soda, thereby giving rise to great increase in bulk; whilst in the goods which were protected from an excess of moisture—as towards the interior of the bales,—and also from the action of carbonic acid, there is only a partial decomposition of the silicate of soda. Mr. Walter Crum has kindly suggested, and I believe the view to be correct, that the cotton fibre has, by its organic nature, a cohesive attraction for silica, which enhances the decomposition of the silicate of soda employed to finish and weight the goods.

From these facts we may assume that there were two destructive influences brought to bear upon the cotton-fibre—1st, that of the increase of bulk resulting from the decomposition of the silicate of soda, giving rise to the formation of free silica and carbonate of soda, which exercised a distending and disintegrating action upon the cellular tissue of the cotton fibre, causing it to burst, and necessarily weakening its tensile strength; 2nd, the direct and destructive action of the free carbonate of soda upon the fibre. The latter appears to be the principal cause of injury, for in the external folds we have a more complete decomposition of the silicate, as shown in the above figures, by the increase in the amount of insoluble silica, and at the same time a decrease of the soda, amounting, as previously stated, to more than two-thirds of the total weight.

We shall now trace more in detail this interesting decomposition of silicate of soda, and endeavour to show what had become of the soda which had disappeared. To attain this object a complete series of specimens were obtained from an entire bale, viz.: 1, a piece which formed the outside and was stained; 2, some of the paper employed in wrapping the goods, which was in immediate contact with the stained cloth; and, 3, some of the flax wrapping placed next to the paper and between the latter and the oil-cloth covering above alluded to. The following are the results yielded by analysis:—

	Pieces of Goods.		Paper Wrapping.		Flax Wrapping.	
	No. 1. Inside fold.	No. 2. Outside fold.	No. 3. In contact.	No. 4. Not in contact.	No. 5. In contact.	No. 6. Not in contact.
Insoluble silica	4·05	5·65	0·02	0·03	0·04	0·01
Silica combined with soda	2·21	0·38	0·09	0·02	0·08	0·03
Soda	1·76	0·25	0·85	0·01	0·29	0·02
Other substances	1·96	1·91	15·15	15·28	1·19	1·26
Total ash	9·98	8·19	16·11	15·34	1·58	1·31

In examining these results we have again a most striking and marked difference in the amount of insoluble silica

and soluble silicate of soda in the two different parts of the same cloth; and, further, where the carbonate of soda has been removed, the folds of the cloth remain comparatively sound. As to the paper wrapping, it is evident that the paper in contact with the goods has absorbed a great part of the soda which was previously combined with the silica, and that the soda is partly in the state of carbonate, and partly in combination with some of the organic matter of the brown paper; for when some of the paper was treated with water, it yielded a yellowish brown substance, which coloured the liquid, whilst the part of the same paper which had not been in contact with the goods did not discolour water in any marked degree. Further, the aqueous solution was neutral, and not alkaline, as in the previous case. As to the flax wrapping, the same difference as noted in the paper was observed, viz., that the part of the wrapping in contact with the stained paper and the stained fabric contained carbonate of soda, whilst that which was in contact with the clean paper contained only a trace. In looking over the bales, a piece of cloth was found, which had been finished with silicate of soda, and was partly overlapped by another piece, showing one-half of its exterior fold stained and comparatively sound, whilst that half of the fold which was prevented from forming the exterior of the bale by being overlapped by the previous one was quite tender and rotten, though it showed no signs of any stains or mildew. I also examined a sound piece which had laid in contact with an injured one, and found that in those folds which had been in contact, there was in the injured piece less soluble silicate, and in the folds of the sound piece a considerable quantity of carbonate of soda, the presence of which could not be found in the folds forming the centre of it.

Having observed that the reserved white patterns of the blue-dipped Indigo cloth were a great deal more tender than the blue portions of the same piece, I carefully cut out a portion of the white parts and submitted them, with the blue parts, to analysis, with the following results:—

	White.	Blue.
Insoluble silica	5·48	3·17
Silica combined with soda...	0·18	2·10
Soda	0·78	1·43
Other salts	1·08	0·67
Total	7·52	7·37

These figures illustrate the fact that the decomposition of the silicate of soda has been carried on to a much greater extent in the white parts than in the blue; and I am led to believe that the cause of the increased rottenness in the white is due to the printer having used a resist-paste too acid, and having found that the whites were slightly tendered, he endeavoured to check the further action of the acid on the cotton-fibre (which, as chemists well know, continues until the cotton fibre is completely destroyed) by the employment of a strong solution of silicate of soda, which, being an alkaline salt, was well adapted to neutralise any acid in the cloth and arrest its action. And as previously only weak solutions of silicate of soda had been employed for this purpose, the printer of these goods could not have foreseen that the use of a more concentrated solution would result in such serious consequences. The above figures also prove another interesting fact, viz., that the white parts of the cloth contain a much larger proportion of silicate of soda than the blues, thus proving that the dyed indigo fibres, being partially filled with this resinous dyeing material, were not in a condition to absorb so largely the silicate of soda.

Messrs. H. Caro and Dancer, who were also employed to investigate this matter, entertain a different opinion as to the cause of the white parts being more injured than the blues. These gentlemen are led to believe from their results that the reason why the whites are more injured than the blues is, that a slow chemical action has ensued between the sulphate of lead remaining from the reserve paste and the silicate of soda, and that a silicate of lead has been formed, and as this salt occupies a larger bulk than the sulphate of lead previously existing in the fibre, the production of it inside the cellular tissue of the fibre has been the cause of the increased tenderness of the whites. But as these gentlemen are engaged in investigating the question more fully, I shall leave to them the pleasure of publishing their results.

Lastly, I deemed it my duty to make some direct experiments on the action of silicate of soda on cotton fibre. I therefore took some white cotton and dyed a portion of it with indigo. This blue-dyed cloth, with a part of the white one, were dipped in a moderately strong solution of silicate of soda, then dried, and a portion of them introduced into a bottle, at the bottom of which a little water had been placed, and, to help the action of the carbonic acid of the *atmosphere*, a slow current of carbonic acid was then passed through the bottles containing the cloths. After three months' time the warps of these samples were tested, and their comparative breaking weights were found to be as follows:—

	On an average of 10 essays.
The warps of the unsilicated cloth dyed blue...	334
The same silicated	299 284 289

These results leave no doubt that the warps, even during the short period of three months, had been considerably injured by contact with silicate of soda. In conclusion, I beg to add that I am aware that silicate of soda has been used for finishing coloured goods, but when employed it has been in a very dilute state, and therefore its destructive action has not been sufficiently marked to draw the attention of calico printers.

Fine Arts.

A Lady Knight.—One of the last acts of the Empress Regent, during the absence of Louis Napoleon in Algeria, was the decoration of the admirable artist, Rosa, or rather Rosalie, Bonheur, who thus becomes *Chevalière* of the Legion of Honour. The cross of the order has never before been conferred upon a woman, with the exception of sisters of charity, members of other religious communities, and *vivandières* who have risked their own lives in performing acts of charity and devotion. Now that the first step has been taken there is little doubt that others will follow. Madame George Sand is by all consent the first writer, the most accomplished romancer, in France, while Madame Henriette Browne and other ladies hold a very high position in the arts. As regards Rosa Bonheur, it is not, perhaps, generally known that that lady belongs to a family of artists: her brother Auguste's landscapes and cattle are deservedly admired; another and younger brother, Jules Isidore Bonheur, is a sculptor, of animals principally, and four of his groups have been rewarded with medals; in the exhibition now open in Paris there are two bulls, modelled by him for the Sultan, which are extremely fine; lastly, Rosa Bonheur has a sister named Juliette, now Madame Peyrol, who is a painter of still-life, and the two ladies have performed good service in the establishment and superintendence of a free drawing school for girls. Moreover, these four artists were all children and pupils of Raymond Bonheur, a painter of merit, who died in 1853. It is not often that the same kind of talent is found thus to mark a whole family.

National Portrait Exhibition.—The Lords of the Committee of Council on Education have received a letter from the Earl of Derby, suggesting the formation of a National Portrait Exhibition, from which letter the following extracts are made:—"I have long thought that a

National Portrait Exhibition, chronologically arranged, might not only possess great historical interest by bringing together portraits of all the most eminent contemporaries of their respective eras, but might also serve to illustrate the progress and condition, at various periods, of British art. My idea, therefore, would be, to admit either portraits of eminent men, though by inferior or unknown artists, or portraits by eminent artists, though of obscure or unknown individuals. I have, of course, no means of knowing, or estimating, the number of such portraits which may exist in the country; but I am persuaded that, exclusive of the large collections in many great houses, there are very many scattered about by ones and twos and threes in private families, the owners of which, though they could not be persuaded to part with them, would willingly spare them for a few months for a public object." * * "The question of one, two, or three exhibitions in consecutive years, would, I apprehend, be mainly decided by the result of future inquiries as to the probable number of pictures which could be obtained, and the space which could be found for their exhibition. But whether the period over which each exhibition (if more than one) should range, be longer or shorter, the point on which I should set the greatest value, in an historical, if not in an artistic point of view, would be the strict maintenance of the chronological series. I shall be very happy if any suggestion of mine should lead the Committee of Council to take up seriously, and carry out, with such alterations of detail as experience might suggest, a scheme which I think could hardly fail of being generally interesting; and I should have much pleasure in placing temporarily at their disposal any portraits from my collection at Knowsley which they might think suitable for their purpose." Their lordships state that they consider these suggestions very valuable, and will carry into effect, in the year 1866, a National Portrait Exhibition generally in accordance with them. They propose to constitute a Committee of Advice, and to invite the Trustees of the National Portrait Gallery to be members of it. Mr. Samuel Redgrave, to whose valuable labours the successful formation of the Collection of Portrait Miniatures is chiefly due, is to be requested to undertake the special charge of carrying this minute into effect.

Artistic Education in Paris.—The Prefect of the Seine appointed a commission, some time since, to inquire into the best means of improving the system of teaching drawing and design in the municipal schools. The commission was presided over by M. Dumas, of the *Institut*, and included amongst its members the Count de Nieuwerkerke, superintendent of Fine Arts, M. Viollet Leduc, architect, M. Gérôme, and other artists. It has just published its report, in which great stress is laid on the necessity for extending the practice of the art of design amongst the population of the capital as a powerful element in industrial success. Considering that the true interests of industrial art cannot be separated from those of pure art, the commission decides that strict examinations shall take place in all the public schools of the city. This list includes all the primary schools, the classes for apprentices and adults, as well as all others which receive a subvention from the municipality. The commission declares the present system of teaching elementary art to be too restricted, and considers special professors absolutely required in order to give the pupils precision of eye, hand, and taste; further, that it is necessary to supply the schools with the best models, to establish special courses of instruction for the various branches of industrial art, and to institute competitions amongst the pupils with the view, not only of stimulating the endeavours, but also of sustaining the zeal of the teachers. The application of the same principles in the case of the female classes is declared indispensable, not only with regard to the cultivation of taste and improvement in industry, but also in a moral point of view, as opening the way for female occupation in those branches of art which do not require physical force but a delicate and tutored hand. In pursuance of the views of the commission, Count de Nieuwerkerke has placed at the disposal of the municipal authorities all the casts and engravings in the Louvre which may be available for Art education in the schools. This is only one instance of the many means that are being brought into operation in France to improve the industrial population, and to maintain for the artistic products of Paris that pre-eminence which in many branches they have so long enjoyed; whilst the large number of artists from amongst which professors and teachers may be secured for the schools gives France, and especially Paris, an immense advantage over most of her neighbours and rivals.

Manufactures.

Platinum.—It has lately been asserted in some journals that this metal for the purpose of boiling sulphuric acid is going out of use, owing to being corroded by the hot acid, and that glass is taking its place. It has been further stated that although platinum by itself is affected by the action of this acid, yet that an alloy of platinum and iridium is not acted upon, and that experiments lately instituted have proved these facts. The contrary is really the fact. Platinum is not going out of use, but, on the contrary, is more largely than ever used for this purpose; and where glass has hitherto been used on account of its cheapness it is being replaced by the dearer article platinum, because the latter is found to be more efficient and in the long run less costly. Boilers, after upwards of thirty years' constant work, have been found practically uninjured and as fit for work as the day they were originally put up. As regards the alloy of platinum and iridium being unaffected by the acid, the fact is that it is very readily acted upon, and wherever tried it has failed. Messrs. Crosse and Blackwell have lately gone to the expense of a platinum steam coil, made of pure platinum tubing, tested to a steam pressure of 60 lbs. to the square inch, to be used by them in boiling the pickling vinegar. This coil is the first of the kind that has been made. It boils 325 gallons of vinegar (the capacity of the vat) in $1\frac{1}{4}$ hours, with steam at 30lbs. pressure. It is made of pure platinum, autogenously soldered. The length of tubing, $1\frac{1}{2}$ inch diameter, consumed, is 32 feet. It was manufactured by Messrs. Johnson and Matthey, at a cost of £800.

Aluminium.—A use seems still to be wanted for this metal, which possesses so many remarkable qualities. At present it is not so much employed in the arts as its very special qualities would warrant. Messrs. Crosse and Blackwell, the well-known manufacturers of pickles and preserves, have lately had made of this material a large boiler, in which their jams and preserves are boiled. By this means all injury from any contact with copper is avoided, and the aluminium is not attacked by the operation.

Silkworm Disease.—The disease amongst the silkworms, known in France by the name of *La Gatine*, has become so serious in that country as to amount to a great public calamity, and its importance is increased by the fact that Italy, Spain, Greece, Turkey, Asia Minor, and a part of China are all suffering from the same cause in a greater or less degree. The French Government has, during the last few years, made great efforts to help the unfortunate silkworm rearers and mulberry tree growers, but with little success, and the subject has been brought before the Senate in the form of a report, made by the celebrated chemist and senator, Dumas, on two petitions presented to the chamber. One of the petitions is signed by more than three thousand five hundred maires, municipal councillors, and landed proprietors of the Gard and neighbouring departments, whence comes nearly all the silk produced in France. The account given by the petitioners exhibits a state of things far more serious than

was generally imagined. M. Dumas says, in his report, that it is impossible to doubt that the gravity, duration, mysterious character, and effects of the disease are most lamentable. All evidence shows that it attaches to the worm and not to the mulberry leaves; but the breeders have become so impoverished that they cannot purchase the leaves, and there is great danger that the losses of the mulberry growers will cause the trees to be uprooted to make place for some profitable crop. A striking proof of the extent of the evil is to be found in the fact that the *Crédit foncier* and other financial societies decline to make any more advances on mulberry plantations. The extent of the misery which has thus fallen on the unfortunate farmers and breeders of the basin of the Rhone may be conceived from the fact that nine-tenths of all the silk of France comes from that district. The cocoons produced in the empire were valued on an average at a hundred millions of francs, or four millions sterling per annum, and in 1853 the total rose to nearly a hundred and twenty millions. To produce this amount of cocoons eight tons of silkworms' eggs, or seed, as it is called, and six hundred thousand tons of mulberry leaves are required. The ordinary value of the former is set down at three to four millions, and of the latter at fifty to sixty millions of francs. In 1856 the disease had reduced the crop to one-third of the average, and one-half an ordinary crop is now considered a large yield. The loss of the mulberry growers, M. Dumas thinks, has probably not been far short of thirty millions of francs a year. The disease has attacked worms from all countries indiscriminately, with the single exception of those bred from eggs brought direct from Japan. The supply of these latter eggs has been considerable, but not sufficient to revivify the business, and besides, the price is so high that the poor breeders have not the means of purchasing them. The Japanese seed costs from twelve to twenty francs per ounce, whereas formerly French seed cost only one or two francs, and was frequently given away. The petitions have been referred to the Ministers of Agriculture of the Colonies and of Foreign Affairs, and means will doubtless be taken to afford temporary relief to the suffering agriculturists. As regards the eggs, the only way of bringing them to Europe safely is in the ships almost specially devoted to the service, as the cases require to be opened and examined on the voyage, and the presence of any strong smelling commodities in the ship is said to have an injurious effect.

Agricultural and Industrial Exhibition at Chaumont.—An agricultural exhibition of the products of the north-eastern departments of France has recently taken place at Chaumont, in the Haute Marne, after an interval of seven years. The horned cattle in the exhibition amounted to 320 heads, amongst which those of the Charolaise race were prominent. These animals, being powerful and precocious, are eminently useful for labour, and their flesh is highly esteemed, but the cows give little milk. The department of the Nièvre alone sends 20,000 beasts to Paris yearly. There were a few Durhams and half-breeds in the show, and a very fine collection of Merino and other sheep, the district being noted for its fine wool. An Industrial Exhibition was inaugurated at the same time, and will remain open till the 20th of July. Chaumont and its neighbourhood are famous, amongst other matters, for cutlery—at Nogent there are eight thousand workmen employed in that trade; also for iron-plate, tools and files of all kinds; the tanneries are extensive, and the glove-trade large and flourishing; cotton and woollen-spinning, wax-bleaching and candle-making, distillation and the timber trade are also extensively developed. There is a large collection of the metallurgical products of the Aube, Isère, Loire, Marne, Meuse, Moselle, Haute-Saône, Vosges, and other departments; a great number of agricultural implements; twenty portable steam-engines; and a variety of objects of general industry and industrial art from all parts of France. The Exhibition is established in a park belonging to the town, and is contained in twelve large pavilions, surrounded by trees, flowers, and statues. Chaumont is rather more than 150 miles from Paris, on the line of the Eastern railway.

Commerce.

Productions of Corsica.—The first general exhibition, which took place lately in Corsica, has been the means of making the resources of that curious island known for the first time to the French public generally. Within the last twelve years the island has been reclaimed from almost a savage state. In 1840 there was but one main road, and no public conveyances; now there nine Imperial and eighteen other main roads, making together 1,744 kilometres, or about 1,000 miles. There are now steamers five times a week, which place the island within twenty hours' journey of Marseilles. The sheep and pigs still, however, maintain rather uncivilised habits, and will not eat in confinement, so that those shown at the exhibition had to be turned loose during the night. The sheep give no wool, but hair, which is made into cord and coarse stuffs for the peasants' winter wear. The olive, vine, orange, citron, almond, fig, and mulberry, flourish luxuriantly in Corsica. There were no less than 250 exhibitors of oil at the late show; and the value of the crop is set down at nearly £160,000 a year. Corsica sends large quantities of oranges, citrons, almonds, and other fruits, fresh and preserved, to Marseilles—the citrons alone amounting to 1,500 tons. The higher mountains are covered with oaks, beach, fir, and other timber trees, which attain magnificent dimensions; the middle region produces chestnuts in a profusion that is to be found nowhere else, and their excessive abundance is cited as one of the causes of the inertness of the rural population. The wooded districts all abound with deer, wild boars, mufflons, and other game; and the Corsican blackbirds are esteemed a great delicacy, and are shipped by hundreds of thousands from Ajaccio, Bastia, and other parts. The mineral productions of the island are, perhaps, better known; the iron works employ about seventeen hundred men, the abundance of wood and the cheapness of sea transport offering great facilities for the trade. The extensive deposits of marble, antimony, copper ore, coal, and other minerals, lie unworked for want of capital. These, together with the cork forests, resinous products, cotton and silk, form the staple of the future prosperity of Corsica, which, in a commercial point of view, must still be regarded as almost in a savage state.

Floating Storehouses for Inflammable Substances.—A slight notice of the new plan of storing dangerous substances, adopted at the new dock and warehouses now being formed at St. Ouen, between Paris and St. Denis, was given in the *Journal* of the 9th of December last. We are now enabled, from personal observation, to furnish particulars respecting the new floating magazines. They consist, in fact, of a series of iron cylinders set up endways, and strapped together, so as to form a huge compound tubular barge. The cylinders, formed of boiler plate, are each about sixteen feet high, and between six and seven feet in diameter, the tops and bottoms being convex, and the former provided with a man-hole. They are arranged in four rows, of twenty-five in each row, and the whole are covered down to the line of flotation with stout planking, which is attached to the cylinders by means of angle-irons rivetted on the latter. The head and stern of these huge floating magazines are provided with hauser-holes for the purpose of towing and mooring them in the basins of the docks. In the case of loading and unloading the magazines may be warped to the dock wall, or the liquids may be pumped in and out from barges. Two of these novel storehouses are now afloat, and two more are nearly finished, as regards the iron-work. As to the docks themselves, a fine square

stone basin, with a surface of 55,000 metres, provided with gates, and also a long and wide canal, are completed, and the iron frame-work of warehouses, six stories high, which will enclose the basin on three sides, is being proceeded with. Immediately in the rear of these three stacks of warehouses are railways, which will bring the latter in direct communication with the Chemin de Fer de Ceinture, which will shortly surround Paris, and which already brings the goods stations of the five great railways in communication with each other.

Colonies.

NEW SOUTH WALES FINANCE.—From the abstract of the sums required to meet the estimated expenditure of the Government of New South Wales for the year 1865, it appears that the total amount chargeable on revenue is £1,434,060 against £1,429,873 appropriated for the year 1864—increase £4,187. The total amount required to be raised by loan, for 1865, is altogether £185,400, against £670,026 for the year 1864. Under the head of special appropriations the amount required for the year 1865 is £391,458, against £341,500 for 1864. This increase of £50,000 is caused by the interest on debentures, which were authorised but only lately issued, and now amounts to £300,000, or £20,000 more than for the year 1864. This will make the debt in debentures actually issued amount to £6,000,000. There is also £16,458 for interest on Treasury bills, and £10,000 for revenue and receipts returned. The total amount required for the year 1865, including loans, is £2,010,918, against £2,441,399 voted for the year 1864.

INDUSTRIES IN NEW SOUTH WALES.—A large timber mill has lately been established on the Goulburn river, and is capable of turning out 18,000 superficial feet of timber per week upon ordinary occasions, but, if pressed, can turn out 25,000 feet. The proprietors have erected a wooden bridge across the Goulburn river, which spans the river 250 feet from bank to bank, by a width of 15 feet, with a roadway of 12 feet. Until this enterprising firm had established these works scarcely a woodman's axe had even been lifted in those parts. The timber that is procurable is of a very fine description, and can be procured at almost any length from 5 feet in diameter to 100 feet in length, but the generality used is from 60 to 70 feet in length. Mostly all the timber on the river's bank is of a first-class description, being, unlike most of the colonial timber, very sound.

TRADE IN MELBOURNE.—It is stated that a company of Melbourne capitalists intend to place a line of light draught steamers on the Murray to trade between Echuca and the ports up and down the river. These vessels are to draw from 18 to 24 feet of water, and are to be constructed of iron.

Obituary.

FRANCOIS CLEMENT MOREAU.—A French sculptor, whose admirable statue of Aristophanes obtained a medal, and is one of the most admired productions in the present Paris exhibition of the works of living artists, was carried off very suddenly a few days since by aneurism of the heart. M. Moreau was little over thirty years of age.

Publications Issued.

FOREIGN MEASURES AND THEIR ENGLISH VALUES. By Robert C. Carrington, F.R.G.S., Hydrographical Draughtsman of the Admiralty. (J. D. Potter, Admiralty Chart Agent.) — Contains a systematic arrangement of the measures of all the countries of the world, with their equivalents in English, as well as a detailed explanation of the metrical system of France, the new decimal systems of Italy, Spain, Portugal, Sweden, &c. The whole work is arranged alphabetically, with a copious index, which also forms a glossary.

ATLAS CELESTE. By Ch. Dien. (Paris.)—This work is said to give more than a hundred thousand stars and nebulæ in the positions they occupied on the first day of the year, 1860, according to the highest astronomical authorities in Europe, and is preceded by an explanatory introduction by M. Babinet, of the French *Institut.*

ANNUAIRE DES SOCIETES SAVANTES DE LA FRANCE ET DE L'ETRANGER. By the Count Achmet d'Hericourt. Two vols., 8vo. (Paris.)—A list of all the learned societies, not only in Europe, but in all quarters of the world, including Oceana.

DESCARTES, SES PRECURSEURS ET DES DISCIPLES. By Emile Saisset. 18mo. (Paris.)—The great French philosopher is taken as the starting point, or rather standard, around which M. Saisset has developed his notes and criticisms on the history of philosophy—Bacon, Ramus, Descartes, Spinoza, Malebranche, Leibnitz are the principle figures in the work; but M. Saisset has devoted a large portion of his attention to throwing light on the more obscure portions of Spinoza's philosophy.

LES ASSOCIATIONS OUVRIERES DE CONSOMMATION, DE CREDIT, ET DE PRODUCTION, EN ANGLETERRE, EN ALLEMAGNE ET EN FRANCE. By Eugène Véron. 18mo. (Paris.)—A small but interesting work on co-operative societies. It has a special value at the present moment, when the Imperial legislature is occupied with a measure for releasing such associations from some of the trammels which now bind them in France.

LE LIVRE DES OUVRIERS A LA VILLE ET A LA CAMPAGNE. By H. Huré and J. Picard. One thick vol.; 12mo. (Paris.)—This is a praiseworthy attempt, by two gentlemen of education, one a professor and the other an officer in the library of Sainte-Geneviève, to furnish the working man with a cheap book of reference on almost all subjects. Religion, morals, the duties of workmen and the legislation that specially affects them, reading, writing, grammar, arithmetic, singing, the useful arts, industrial biography, geography, and history are the subjects of the work, which is systematically and not alphabetically arranged.

GUIDE PRATIQUE DE L'INGENIEUR AGRICOLE. By Jules Laffineur. (Paris.)—Soil, drainage, irrigation, and all the operations which form the basis of scientific cultivation, are treated in this work.

Notes.

SOUTH KENSINGTON MUSEUM.—The Lords of the Committee of Council on Education have appointed a commission to inquire into the warming and ventilation of the galleries containing works of fine art at the South Kensington Museum. The Commission consists of Prof. Graham, Master of the Mint; Prof. Tyndall, Dr. Percy, Dr. Frankland, Colonel Scott, R.E., and Captain Donnelly, R.E.

ELECTRIC TELEGRAPH.—Algiers is now connected with France by the electric wire. The price of a message from Algiers or Tunis to Paris is eight francs for twenty words, this being only two francs more than the cost of a similar message from Boulogne to Worthing, which is six francs, that is to say, the same as a despatch from Paris to London.

BREAD of this year's wheat was sold in Paris a few days since; of course this wheat was grown in the Marseilles district, which is actually a southern climate.

Correspondence.

SUBAQUEOUS RESPIRATOR.—SIR,—Not reading the *Journal* with that regularity which its contents deserve, it was

only to day that I perused the article "Respiratory Apparatus," in No. 651. It is there stated that M. Galibert has invented an apparatus for affording a supply of air to persons working under water, &c., that is so much like an apparatus invented by my father, illustrated and described by him in the *Mechanic and Chemist*, November 23, 1839, that nearly every reader will see that there is the same train of thought and reasoning for attaining the same end. Without being biassed in its favour, I think my father's invention would obtain the preference, for he suggested that the air-bag should be filled with a mixture of one-thirtieth more oxygen than ordinary air. The copper bag carried on the back is described by him as containing condensed air, which issues gradually and regularly into the hood. With this apparatus a diver, carrying weights round the waist, which he could release when he wanted to come up, would be enabled to explore for a quarter of an hour together the bottoms of canals, lakes, rivers, &c. In thus writing I do so to claim for my father a priority of twenty-six years in this idea.—I am, &c., Charles Piesse.

Royal College of Chemistry, June 17th.

MEETINGS FOR THE ENSUING WEEK.

Mon. .. Entomological, 7.
Asiatic, 8.
Royal Inst., 2. General Monthly Meeting.
Tues. ...Ethnological, 8. 1. Dr. Donovan, "Craniology and Phrenology in relation to Ethnology." 2. "Photographs from Central America," communicated by Mr. E. B. Tylor. 3. Professor Bell, "On Visible Speech."
Fri.......Archæological Inst., 4.
Sat.......R. Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Num.

Delivered on 26th May, 1865.

344. Railway Trains—Circular of 30th July, 1864, from the Board of Trade.

Delivered on 14th June, 1865

191. Bills—Companies Workmen's Education.
205. ,, Personages.
206. ,, Crown Suits, &c. (as amended in Committee).
207. ,, Inland Revenue (as amended in Committee).
208. ,, Comptroller of the Exchequer and Public Audit.
350. Hampstead Parish—Return.
355. Anchors—Return.
356. Civil Services—Supplementary Estimate, Class I. Vote 28 (National Gallery Enlargement).
North America, No. 5 (1856)—Correspondence respecting the Assassination of the late President.
Public General Acts—Cap. 26 to 37.

Delivered on 15th June, 1865.

211. Bills—Ulster Canal Transfer.
212. ,, Greenwich Hospital (as amended in Committee, and on Re-commitment).
300. Valuation of Lands and Heritages (Scotland)—Report.
345. East India (Public Works)—Letter.
358. Salmon Fishery Act (1861) Amendment Bill—Minutes of Proceedings.

Delivered on the 16th December, 1865.

200. Bills—Falmouth Harbour.
210. ,, Pier and Harbour Orders Confirmation (No. 3).
213. ,, Penalties Law Amendment (as amended in Committee).
214. ,, Harwich Harbour (as amended by the Select Committee).
215. ,, Fortifications (Provision for Expenses).
125. East India (Finance and Revenue Accounts)—Parts I. and II.
347. Mails (England and India)—Memorials.
359. Lunatics (Ireland)—Return.
Births, Deaths, and Marriages—Supplement to the Twenty-fifth Annual Report of the Registrar General.
Life Annuities—Tables.
Passages on board Her Majesty's Ships "Liffey" and "Phœbe"—Correspondence.

Patents.

From Commissioners of Patents Journal, June 23rd.

Grants of Provisional Protection.

Axes and other tools—1558—T. Smith.
Bonnets and hats, composition used in manufacturing—1442—J. Eustace.
Carbonaceous substances, distilling—1553—J. Howarth.
Cheese-manufacture—1535—P. Coombes.
Combustible matters, preventing the ignition of—1515—H. Allman.
Dress, machinery for making articles of—399—D. Barr, W. H. Page, J. C. Newey.
Economic boiler for hot-water apparatus—1510—F. Knight.
Electro magnetic clocks—1518—R. A. Brooman.
Exercising chair for infants—1508—T. Brinsmead.
Fabrics, machinery for raising the pile of—1514—W. E. Newton.
Fire-arms, breech-loading—1546—G. Haseltine.
Fire engines—1404—J. Shand.
Gas meters—1548—H. H. and J. F. G. Kromschroeder.
Hand stamp for printing letters, &c.—1536—A. J. Aspinall.
Heat generation—1559—W. Sim and A. Barff.
Hides, tanning—1554—A. C. Henderson.
Hydraulic apparatus, &c., construction of cylinders, &c., used in—1505—H. Allman.
Inkstands—1484—B. Lawrence.
Iron bars, &c., machinery for bending and straightening—1532—C. de Bergue.
Lace machines—1512—H. Mallet.
Marine engines, actuating slide-valves of—1538—J. Robertson.
Measuring the human figure, apparatus for—1528—E. Eastman.
Milk, apparatus used when boiling—1520—G. Kent and W. H. West.
Motive power—1504—D. Hancock and F. Barnes.
Oil-feeders—1556—F. Foster.
Printing surfaces, process for producing—1522—F. J. Bolton and H. Matheson.
Railway break—1542—F. Tolhausen.
Railway signals—1502—H. Martin.
Safety apparatus for steam-boilers—1523—J. Shepherd.
Screw-propelling apparatus—1118—R. Griffiths.
Soap-manufacture—1540—R. A. Brooman.
Steel manufacture—1560—J. Ferguson and R. Miller.
Submerging telegraphic cables—1544—J. Kennedy.
Tents and stalls—1315—E. Cordonnier.
Turbines—1534—T. Gentle and J. Allmark.
Valves—1516—J. Nuttall.
Vessels, apparatus for propelling and steering—1481—J. Jopling.
Water closets—1364—F. Fletcher.
Wool-combing machinery—1550—R. A. Brooman.
Yarns or threads, twisting or doubling—1530—W. Townend.

Inventions with Complete Specification Filed.

Arbutus, obtaining syrups, &c., from the—1649—P. Mingaud.
Carriage lamps—1637—W. and W. Howes.
Electric signals for railway trains—1609—A. E. Brae.
Hygrometric condition of the atmosphere, apparatus for indicating—1610—W. Edson.
Vehicles, apparatus for facilitating the traction of—1626—H. A. Bonneville.

Patents Sealed.

3090. E. W. Otway.	38. G. A. Buchholz.
3214. H. Hicklin and C. Pardoe.	48. C. de Bergue.
3216. G. Alton.	73. S. S. Brown.
3217. G. Alton.	225. J. Harrison.
3221. J. Cleaver.	311. F. C. Hills.
3222. J. R. Breckon & R. Dixon.	320. W. E. Newton.
3232. J. Millar.	344. W. Sim.
3233. M. A. Muir & J. McIlwham.	348. W. E. Newton.
3237. J. Dodd.	406. F. C. Vannet.
3242. B. Baugh.	409. W. E. Newton.
3248. H. A. Bonneville.	446. C. O. Staunton.
3251. W. H. Brown.	1024. S. Wright.
3255. P. A. Roger.	1107. H. Caudwell.
3258. R. Quin.	1165. C. W. Heaven.
3259. T. Du Boulay.	1256. E. Richardson.
16. T. J. Ashton.	

From Commissioners of Patents Journal, June 27th.

Patents Sealed.

3236. T. R. Harding.	27. N. Thompson.
3239. W. Nadler & A. Belcher.	29. W. Watson.
3244. E. Perce.	39. T. Pickford.
3253. J. Ladley.	50. T. Richardson and M. D. Rucker.
3256. T. Richardson.	53. G. Reymond.
3. M. R. Leverson.	90. R. Tempest.
4. E. Bevan and A. Fleming.	234. W. Clark.
6. J. Smith, jun., and J. Williamson.	247. S., R., and W. Trulock.
7. J. Spencer & N. Broomhead.	535. J. Starley.
9. R. Irvine.	958. G. T. Bousfield.
14. H. Lloyd.	1092. G. T. Bousfield.
26. G. Kent.	1192. J. Bernard.

Patents on which the Stamp Duty of £50 has been Paid.

1820. D. Adamson and L. Leigh.	1844. H. Ponsonby.
1832. H. and J. Davenport.	1867. E. H. Huch and F. J. Windhausen.
1828. F. E. Schneider and J. Snider, jun.	1890. I. Holden.
1841. E. Edmonds.	1891. A. A. Croll.

Patents on which the Stamp Duty of £100 has been Paid.

1400. W. E. Newton.	1463. J. Shaw.
1422. W. E. Newton.	1464. J. Shaw.
1415. T. Spencer.	

THE

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111th Session.] FRIDAY, JULY 7, 1865. [No. 659. Vol. XIII.

TABLE OF CONTENTS.

Proceedings of the Society.

Musical Education Committee.

The following is a continuation of the information relating to Musical Education on the Continent, collected by this Committee :—

AUSTRIA.

The well-known Conservatoire of Music at Vienna forms a part of a general association, entitled, "The Society of Friends of Music in Austria," established for the cultivation and promotion of music. The following is a translation of a characteristic official document, setting forth the circumstances which gave rise to the establishment of the Society, and the history of the Conservatoire itself* :—

In the year 1811, an association of noble ladies, having for its object the encouragement of works of beneficence and utility, was established in Vienna. This association, which since that period has been in constant activity, was engaged in discussing by what means substantial assistance could be rendered to the inhabitants of the seat of war beyond the Danube, as well as to the town of Baden, which had recently suffered from a fearful conflagration, to which end it was requisite to raise from the charitably-disposed contributions to a considerable amount.

Fanny, Baroness von Amsteim, one of the leading members of the association, a lady of rare merit and unbounded liberality, conceived the idea of giving a concert on a grand scale, and in a building the most capacious that might be obtainable for the purpose. The well-known instrument maker and pianiste, Herr Streicher, suggested the performance of Handel's great work, "Alexander's Feast," with Mozart's additional accompaniments, a selection which was creditable alike to his taste and discernment. His Majesty the Emperor Francis granted permission for the rehearsals to be held in the new "Rittersaal" of the Palace, the concert itself in the imperial riding-school, defraying, moreover, the expenses incurred in fitting up this magnificent building for a concert-room.

With her characteristic activity the Baroness, assisted by Herr Streicher, issued invitations to the votaries of music of all ranks to co-operate in the undertaking. Prince Lobkawitz, an enthusiastic amateur, whose wife was the first lady-president of the association, arranged for the preparatory vocal rehearsals at his own hotel. The required number of instrumental performers was soon complete, and the first performance of the work, under the title of "Timotheus, or the Power of Music," came off on the 29th of November; the second on the 3rd of December following; Herr Streicher leading on the pianoforte. The Hofrath von Mosel was conductor. The orchestra numbered 720 individuals of all classes, who cordially united in giving this grand musical treat for so praiseworthy an object.

The multifarious arrangements, which were more numerous than it might be supposed, were chiefly carried out by Count Dietrichstein, the treasurer of the Association, and the privy councillor, Herr J. Sonnleithner, whom the Emperor, as founder of the society, had appointed to be its permanent secretary.

A few days before the second performance, Herr Sonnleithner was struck with the idea that, from the general enthusiasm aroused by Handel's great classical work, hopes might be entertained of realising a long cherished desire, namely, to unite the numerous assemblage of the lovers of music into a permanent society, having for its object the encouragement of the art in all its branches, and the foundation of a Conservatoire, which latter had long been a desideratum in Vienna. Great composers had here formed themselves, independently of extraneous aid (gleichsam aus sich selbst gebildet); such an establishment would tend to the development of similar talent, which only needed opportunity to discover its latent powers, and a guiding spirit to direct it on the right course. Now, when a vivid interest was awakened, appeared to be the most favourable, perhaps, indeed, the only opportunity which augured success, but it was necessary that no time should be lost. Herr Sonnleithner drew up a programme, briefly setting forth the advantages to be derived from such a reunion of amateurs, and the formation of a regular society, and inviting those who might be desirous of joining to enter their names in a list, which was opened for the purpose at the hotel of Prince Lobkawitz, by which entry they were only to be bound in case the rules of the society, when drawn up, should receive the Emperor's assent. The proposition was eagerly entertained by those who had taken part in the performance of "Timotheus," and in a few days the number of entries exceeded 1,000. Various motives, no doubt, concurred in bringing about this result; many were desirous of hearing musical works of a high standard brought forward in a manner worthy of their reputation; many were desirous of taking part themselves in the performances; while all were actuated by the laudable wish of aiding in the establishment of a school in which pupils might be fittingly trained. Upon this, the leading object of the Association was declared

* Extract from the Annual Report for 1860-61.

to be the elevation of music in all its branches, to which individual practice and enjoyment were to be considered subordinate.

For the attainment of this prime end a Conservatoire of Music was to be established, in which pupils of both sexes from the various Austrian provinces might receive instruction in singing, in declamation, instrumental music, practical thorough bass, in composition, in languages, and other collateral subjects. Works of classical repute, already in existence, were to be performed under the auspices of the Society, partly in order to create a higher standard of musical taste, and partly thereby to awaken germs of talent in the pupils, and to excite in them the desire of obtaining similar distinction in musical composition, in which they would be encouraged by rewards from the association to such an extent as its means would allow.

In 1816 the Association found itself in a position to warrant its proceeding with such an undertaking. Hofrath von Mosel, being requested to draw up a scheme for this purpose, at once undertook the task, and on his plan the course of study was based. It having been laid down as a principle that all the pupils, even those who intended to devote themselves in future to instrumental music, should previously receive instruction in singing—a school for singing was in the first instance organized, and opened on the 1st of August, 1817. In 1819 the violin school was opened, and as the pupils in the singing school had already made considerable progress in their elementary studies, and it became necessary that they should receive instruction in the more advanced stages (which is of an essentially different nature), a third class was instituted for those among the female students whose talents and assiduity held out a promise of higher development. In 1821 the course of study pursued had been attended with such success, that the association began to think of enlarging the establishment, and in order to meet the largely-increasing outlay found it necessary to invite a special subscription, and several liberal patrons put down their names for various amounts for a term of six years. In 1823 the pupils had already made such progress that it was resolved on holding an examination in presence of the assembled members and the public generally, and it was accordingly held in the hall of the Lower Assembly.

An unexpected opportunity for bringing the pupils of the Conservatoire into public notice occurred in 1825, owing to the closing of the Court theatre adjoining the Kärntnerthor. Permission was granted for the performance of two concerts, which were given on the 30th October and 9th November, and met with general approbation. In the same year the students were presented, in the great hall of the society, to its illustrious patron, his Imperial Highness the Cardinal Archduke Rodolph. It was resolved, in order to excite the emulation of the students, to distribute premiums among such of them as showed the greatest proficiency, partly in the form of silver medals, and partly in useful musical works.

The progress made by the Conservatoire induced all those who had given a year's subscription to promise a continuance of the same.

Up to the year 1830 the operations of the Institute were carried on in hired premises, until at length the society, having attained a recognised position, was enabled, by the liberal assistance of its patrons, to acquire possession of the house No. 558, Unter den Tuchlauben, and to undertake the necessary additions thereto. The pupils were now enabled to practise in concert in the music-hall of the Society, their exercises becoming thereby of additional interest. Public performances were given regularly from 1831 till 1847, the proceeds from which were applied partly in establishing scholarships for the more talented pupils and partly to charitable purposes. On two occasions (on the 29th March, 1837, and the 21st of the same month in 1847) the students had the honour of performing in the presence of the Imperial Court. After a short interruption, caused by the events which occurred in 1848, the operations of the school were resumed, with certain alterations which, through the progress of time, had become necessary; and notwithstanding many obstacles in the way of their fuller development, carried on to the present time. That its advancement has been in no wise behind that of similar institutions in other countries is mainly owing to the disinterested zeal of those men who have, for very inadequate remuneration, devoted their professional talents and experience to the artistic education of their successors.

The course of study embraces every kind of musical education except the organ, for which, unfortunately, space has hitherto been wanting. There is a singing class for boys, one for girls, two for the pianoforte, three for the violin, and one each for the violoncello, double bass, flute, clarionet, horn, trumpet, trombone, &c., in addition to thorough bass, composition, recitation in German and the Italian languages. The study of acoustics, the history of music, and other collateral subjects, for which competent teachers could have been obtained free of expense, were, however desirable, omitted for want of sufficient accommodation. For the last ten years the annual number of pupils has been very nearly 200, of whom more than two-fifths received entirely gratuitous instruction; besides these, from 40 to 50 have each year been refused admission for lack of space. There have also always been among the students some who have been received into the Conservatoire on special grounds—such as military bandsmen, pupils from the asylums for the blind, &c. The annual results of the instruction given are brought into notice through public examinations, which, more especially of late years, have been remarkably well attended. The concerts given by the pupils, under the able direction of Herr Hellmesberger, gave evidence—not only of their marked advance in individual proficiency, but also of the advantage derived from their practising in concert.

Had it not been for the liberal support all along accorded to the Conservatoire by its illustrious patrons, it would have been impossible for the society, notwithstanding the most strenuous efforts, and notwithstanding the unceasing self-devotion of the professors, to have placed it on an established foundation. In this respect it must ever hold in cherished remembrance one of its earliest patrons—the late Archduke Cardinal Rodolph, who, himself an accomplished amateur, took through life a deep interest in its success, after whose lamented decease his illustrious brother, the Archduke Anthony Victor, was graciously pleased to undertake its protectorate, and accorded to it numerous liberal tokens of his favour. The society has also to be deeply thankful to his Majesty the Emperor Ferdinand the First for an annual contribution, for three years, of 3,000 florins from the Imperial Treasury, granted in 1842, and afterwards extended for three years in addition, that is to say, till 1848; and since 1851 it has been in receipt, through the favour of the Emperor Francis Joseph the First, of a like annual amount up to the present time. In consideration of the advantages derived from the Conservatoire, the Common Council of Vienna, in the year 1851, voted an annual subscription of 2,000 florins, since extended for a term of six years, besides special gifts, which the Society for its general utility, has received on various occasions from members of the Imperial family, as well as from the Emperor's privy purse, and the liberality of private amateurs.

This document concludes with a list of 130 vocalists and instrumentalists, of greater or less note in the musical world, who received their education in the Conservatoire. The society is governed by a president, vice-president, and 12 members, elected for three years, but re-eligible. The Conservatoire is divided into the administrative branch and the artistic branch. The former is governed by a "referent" and 24 inspectors of the different schools into which the Conservatoire is classed; the latter by an artistic director and 23 profes-

sors of different lengths of service from 43 years downwards. The number of pupils in the year 1863-4, was 309, of whom 199 were males and 110 females; 106 of the number paid no education fees, and 33 half-fees only. The charge for education is described as the smallest existing anywhere.

The following are some of the provisions of the statutes of the general society, the chief objects of which are stated to be (1) the maintenance of a Conservatoire; (2) the public performance of good musical productions; (3) the maintenance of a musical library and its appurtenances; (4) general vocal and instrumental rehearsals and performances of the members; and (5) the encouragement of rising musicians by experimental or public performances of their works or otherwise.

The society consists of honorary and ordinary members, the latter comprising supporting or subscribing (unterstützend) members paying 10 florins* a year (16s. 8d.) of which 4 fl. is applied to the Conservatoire, participating (theilnehmend) members, paying 6 fl., and effective (augübend) members praying 4 fl. and assisting by singing or playing. A general meeting of the society is held every year for receiving the reports of the direction and other business. The directors of the society have a discretionary power of relieving, wholly or partly, from education fees those of the pupils in the Conservatoire whose means are insufficient, and who prove themselves deserving of such a privilege by one year's attentive study. The directors have also a general control over the affairs of the Conservatoire. The society gives four public concerts a year under the management of the artistic director, besides extra concerts. For the purpose of rehearsal and performance of the members, the society is divided into a vocal union (sing-verein) and an orchestral union (orchester-verein), both of which have the right of using the society's hall once a week free of charge. Each union has to make an annual report to the directors.

The following particulars are taken from the annual report presented to the general meeting of the society on the 21st December, 1864:—

Out of the total number of 309 pupils above mentioned, 42 were in the school for wind instruments, 58 in that for stringed instruments, 118 in the piano school, 35 in the boys' singing school, 31 in the girls' singing school, &c., &c. A pension fund for the professors of the Conservatoire has just been established.

The total receipts of the Society and Conservatoire for the year 1864-5 are estimated as follows:—

1. Receipts of the Society.

	Florins.*
Balance from last year	2,126
Ordinary contributions of members	5,400
Extraordinary ditto	1,000
Receipts from concerts	2,500
Interest on investments	1,131
House rent, &c.	2,400
Rent of hall	3,500
Charges for heating and lighting	520
Total	18,577

Receipts of the Conservatoire.

Contributions of supporters (including 3,000fl. from the State, 2,000fl. from the commune of Vienna, &c.)	5,200
Matriculation fees	150
School fees	8,000
Interest on investments	152
Total	13,502
Grand total	32,079

* The florin is equal to 1s. 8d.

The expenditure is estimated as follows:—

1. Expenditure of the Society.

	Florins.
Salaries and fees	2,154
Expenses of concerts	6,000
Interest on mortgage	2,320
Paid off mortgage	2,100
Taxes, &c.	2,350
Cost for heating and lighting	2,100
Library, printing, and miscellaneous expenses ..	2,640
Total	19,664

2. Expenditure of the Conservatoire

Salaries	9,400
Fees (remunerations)	1,400
Purchase of musical instruments and other expenses	656
Total	11,456
Grand total	31,120
Surplus of receipts over expenditure	959

The assets of the society are stated to include the following items:—

	Florins.
(1.) Balance in hand as above	2,126
(2.) Purchasing price of the Society's old houses	43,050
(3.) Value of the existing house, after deducting mortgage of 46,000 florins	25,200
(4.) Investments (nominal amount)	20,420
(5.) Cash balance at the bank	1,050
(6.) Value of library, musical instruments, furniture, &c.	23,200

The Conservatoire has assets consisting of investments of the nominal amount of 3,200 florins.

The society is just commencing the erection of a magnificent new building for which the Government has granted a site and half the produce of two lotteries. In connection with this structure is to be a great monument in honour of Gluck, Haydn, Mozart, Beethoven, and Schubert, towards the erection of which a special fund of 5,000 florins has been raised.

BOHEMIA.

By an arrangement similar to that adopted in Austria, the association established at Prague, and entitled "The Society for the Promotion of Music in Bohemia," is combined with and directs a musical institute known as the Conservatoire of Prague.

The society consists of three classes of members, viz.:

(1.) Contributing, paying 40 florins and upwards a year.

(2.) Effective, possessing musical knowledge, living in Prague and not holding office in the Conservatoire.

(3.) Honorary.

The society professes to train members of orchestra, solo players, and singers for concerts and stage, and by means of good musical productions to spread a taste for music, giving public performances of the pupils. The society is governed by a president and six members, elected for three years and re-eligible. The statutes contain minute rules for their guidance, and for the working of the society, instructions to the office bearers, &c.

A pension fund is connected with the Conservatoire for giving pensions to the directors, professors, &c., and also to their widows; the necessary funds being raised by an annual per centage on the net receipts of the concerts, &c., &c. The pensions vary from one-half the salary when the service has been under ten years, to the whole salary when it exceeds 20 years; and the widows receive 200 florins a year. The fund is managed by a President, who is the head of the general society, three other members of the governing body of the society, two

professors, and the directors of the Institute. The course of proceeding is defined by statutes. The fund amounted to 8269 fl. at the end of 1864.

The Conservatoire contains an instrumental school and a singing school, divided into a concert school and an opera school, all governed by minute statutes. The yearly report for 1864 shows that the society had thirteen honorary, six effective, and seventy-nine contributing members, subscribing 5,481 fl. It possessed a capital of 20,947 fl. The receipts for 1865 (including a balance in hand of 2,363 fl.) are estimated at 13,820 fl., of which 4,200 fl. is a subvention by the Government from the "Landesdomestical" fund, 5,349 fl. subscriptions, 900 fl. interest, 500 fl. net produce of concerts, and the rest miscellaneous. The expenses are estimated at 12,432 fl., viz: 6,704 fl. salaries, 2,075 fl. allowances, 915 fl. pensions, 690 fl. taxes, &c.

The Instrumental School where the term of education is six years, contained 57 pupils in the 1st class admitted in 1861, and 43 pupils passed out of the Conservatoire as qualified in the 2nd or higher class admitted in 1858; of these 43, 27 at once obtained appointments in orchestras, &c. The Opera School, with an education of from two to three years, contains five females and one male, and the Concert School, where the term of education is two years, 10 female pupils. All the pupils receive a general as well as a musical education. Three concerts, producing 605 fl. net, were given in the year 1864. The education is gratuitous for natives in all the schools. Foreigners pay 60 fl. a year in the Instrumental and Concert schools and 80fl. in the Opera school.

Proceedings of Institutions.

Abersychan Literary and Scientific Institution.—The report for the past year, read at the annual meeting of the members, on the 27th February last, congratulates the members on the favourable position the society has attained in this the first year of its existence. Thanks to the proprietors of the works at this place, and to their manager, Mr. Richards, a room has been provided and set apart for the purposes of the Institution; and everything to adapt it to the convenience of the members has been provided by them free of cost. In February, 1864, the first meeting of the society was held. In the first quarter the number of members reached about seventy, and this number has been steadily maintained throughout the year. The books purchased by the society during the year number altogether 92 volumes. The issue during the year has not been large, numbering about 140 volumes, with a proportionable number of periodicals. The financial statement shows that the income has amounted to £54 7s. 7d., and that there is a balance in hand of £13 13s. 11d.

Ashton and Dukinfield Mechanics' Institution.—The last report shows that the number of members is increasing, and the directors have spared no pains to meet that increase by increased attractions. In the early part of the year the directors opened an Exhibition of Paintings and Works of Art. The exhibition was open three days, and gave general satisfaction. The discussion society, which meets on alternate Monday evenings, is well attended, and its meetings are a source of great interest to its members. A chess and draught club has also been established. Both these societies are open to the members on payment of a small annual subscription. The number of members was 551 at the date of the issue of the report, showing an increase of 31 over the former year. The classes now in operation are:—Writing, arithmetic, grammar, geography, and mathematics; present number of members, in senior class, 60; in junior class, 52: French, mechanical, architectural, and freehand drawing. The Committee of Council on Education have awarded the Bronze Medal of the Art Department to several pupils. The present number of volumes in the library is 3,616, being an increase of 146 over the previous year; the total number of issues is 7,416. In the reading and news room reports from the Liverpool cotton market, and from the leading corn and produce markets are regularly laid upon the telegram stand, so that those interested in trade may obtain information which will prove of value to them. The financial statement shows that the receipts have amounted to £315 13s. 11d., and that there is a balance in hand of £4 14s. 6d.

Burnley Mechanics' Institution.—The report for last year says that the continued depression of trade has rendered it expedient that the efforts of the directors should almost be exclusively directed to maintain unimpaired the usefulness of the leading departments of the Institution. The circulation of books for the year amounts to 7,660 volumes, and the total number of volumes in the library is 4,436. The class registers show in the aggregate a small decrease in the number of members, the number of males being 150, females, 66; total, 216. In 1863, the numbers were—males, 177, females, 47; total, 224; decrease of males, 27; increase of females, 19; making the absolute decrease since 1863 to be 8. In the manufacturing districts of Lancashire, where the demand for female labour is such that girls are removed from school or domestic employment at an early age, a well-devised system of secondary education for females is of the greatest social importance. The directors have been desirous to make the female classes attractive, and adapted to their special duties. A series of lectures and conversations, by Dr. Brumwell, on Domestic Affairs, and subjects intimately connected with them, have been held for the benefit of the members of these classes and their female friends. Generally the attendance of the members at the classes has been regular, and their progress commendable; these remarks especially apply to those who entered the various examinations during the year. In the year 1863 the number of members was 364; in the year 1864, 347; decrease, 17. Out of the 17 removed from the list, 15 have become subscribers to the Exchange, so that although not counted, they still remain members of the Institution. The Exchange register exhibits a large addition of subscribers, the numbers being, residents, 249; non-residents, 165; total, 414. In 1863 the numbers were, residents, 221; non-residents, 88: total 309. Increase in the year 1864, 105. This remarkable increase of subscribers, and the consequent crowding of the room on market-days, rendered larger space and increased accommodation necessary; this has been supplied. The financial statement shows that the income has been £498 8s. 9d., and that there has been an excess of expenditure amounting to £51, which may be ascribed to the large outlay on the improvement of the Exchange, and to the absence of the usual item of profit arising from a public soirée. About the time of making arrangements for this festival the state of trade was so appalling, that the directors decided that it was inexpedient to hold a soirée under such circumstances.

EXAMINATION PAPERS, 1865.

(Continued from page 538.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April last:—

MENSURATION.

THREE HOURS ALLOWED.

1. Prove that a rain-fall of an inch gives about 100 tons to the acre. What would a fall of a centimetre give to the hectare?

2. Show how to measure a given parallelogram.

The perpendicular distances between the opposite sides of a parallelogram are to be two and three inches; find the

area of the least parallelogram which satisfies this condition; and construct another which is twice this area, and satisfies the same condition.

3. Explain the construction and use of the *diagonal scale*.

4. Find the area of a right-angled triangle, one side of which is 15 inches, and the hypothenuse $3\frac{1}{4}$ feet.

5. A rectangle is 8ft. 6in. long, and 4ft. 9in. broad, find its cost at 1s. 6d. per foot, by duodecimals.

6. Draw a plan, and find the area of a field from the following notes :—

	444 to A
132 264	
	From C on R
	336 to C
	From B on R
	564 to B
	From A

7. Prove that the perimeter of a square is less than the perimeter of a rectangle of the same area.

Find the least number of hurdles, each 2 yards long, which will enclose an acre of land of rectangular shape.

8. Find the cost, at £6 15s. per rod, of the outer walls of a house 35ft. wide, 28ft. 6in. deep, and 35ft. to the roof, there being a gable at each end, rising 32 courses of bricks, reckoning 4 courses to a foot, the first 12ft. being 2 bricks thick, the next 15 being $1\frac{1}{2}$, and the rest 1 brick thick.

9. Find the area of a circle whose diameter is 113 inches, and circumference 355.

10. Find the diameter of a 600-pound cannon ball whose specific gravity is 7·2.

11. The curved surface of a circular cylinder is 10ft., the areas of its two ends the same as that of a circle 10in. in diameter: find its volume, and the weight of the water which it will contain.

12. Prove that the volume of any pyramid is equal to one-third of its base into the height.

TRIGONOMETRY.

THREE HOURS ALLOWED.

1. Find the circular measure of $2^g\ 4'$ French and of $1°\ 50'\ 9''{\cdot}6$ English.

2. Prove that $\text{Sin. } 2a = \dfrac{2 \tan. a}{1 + \tan.^2 a}$

And that $\text{Cot. }(a-b) = \dfrac{\text{Cot. } a \text{ Cot. } b + 1}{\text{Cot. } b - \text{Cot. } a}$

3. If A B C be a triangle, sides $a\ b\ c$, then $c^2 = a^2 + b^2 - 2\,ab$ Cos. C. Adapt this to logarithmic computation.

4. A B C is a triangle, and A D meeting the base in D divides angle A into two angles, m and n, so that $\dfrac{\text{Sin. } m}{\text{Sin. } n} = \dfrac{c}{b}$

Prove that Cot. m—Cot. n = Cot. C—Cot. B; the angle B A D = m.

5. Prove that—

(1) $\dfrac{\text{Sin. }(2a+b)}{\text{Sin. } a} = 2 \text{ Cos. }(a+b) + \dfrac{\text{Sin. } b}{\text{Sin. } a}$

(2) Cosec. $2a$ + Cot. $4a$ = Cot. a—Cosec. $4a$.

6. Find a when

(1) Sin. $5a = 16$ (Sin. a)^5

(2) Sin. a + Sin. $2a$ + Sin. $3a$ + Sin. $4a$ = 0.

(3) Cos. a—Cos. $2a$ = Sin. $3a$.

7. If A B C be the angles of a triangle—

(1) a (b Cos. C—c Cos. B) = $b^2 - c^2$

(2) $\dfrac{\tan. A}{\tan. B} + \dfrac{\tan. B}{\tan. C} + \dfrac{\tan. C}{\tan. A} + \dfrac{\tan. C}{\tan. B} + \dfrac{\tan. B}{\tan. A} + \dfrac{\tan. A}{\tan. C} = \text{Sec. A Sec. B Sec. C} - 2.$

8. In a right-angled triangle C = 90° : c = 7584 : b = 3000; find B, when

log. 7·584 = ·8798983 : log. 2 = ·30103

log. sin. 34° 59′ = 9·7584105 : diff. for 1′ = ·0001805

9. A D and B E are perpendiculars from the angles A and B of the triangle A B C on the sides opposite. Show that D E = c Cos. C.

10. The radius of the circle inscribed in a triangle,

$$= a \text{ Sin.}\frac{B}{2} \text{ Sin.}\frac{C}{2} \text{ Sec.}\frac{A}{2}$$

11. Sum the following series to infinity—

$$\text{Sin. } a + \frac{1}{1.2} \text{ Sin. } 2a + \frac{1}{2.3} \text{ Sin. } 3a, \text{ \&c.}$$

12. The elevation of Cader Idris, at a point in the valley near Dolgelly, is Cot. $^{-1}6$; at Ty Gwyn, $3\frac{1}{2}$ miles down the valley, it has the same elevation; at a point half-way between, its elevation is Cot. $^{-1}5$. Show that its height above the valley is $\dfrac{7}{4\sqrt{11}}$ miles.

13. In a spherical triangle find the sine of the angle in terms of the sides.

14. Find the area (s) of a spherical triangle in terms of its angles.

15. And then show that—

$$\text{Cot.}\frac{s}{2} = \text{Cot.}\frac{a}{2} \text{ Cot.}\frac{b}{2} \text{ Cosec. C} + \text{Cot. C}$$

16. Given B, a and b, and Cot. θ = Cos. b tan. a,
Prove that Sin. $(c + \theta)$ = Cos. b Sin. θ Sec. a

CONIC SECTIONS.

THREE HOURS ALLOWED.

SECTION I.—GEOMETRICAL CONICS.

1. Define a cone, a parabola, the focus of a parabola, the diameter of a conic. Show that in a parabola the sub-normal is constant, and the sub-tangent is double of the abscissa.

2. In the parabola prove that $NP^2 = 4AS \times AN$.

3. Tangents which meet on the directrix of a parabola are at right angles to each other; and the line which joins the points of contact passes through the focus.

4. Define tangent of an ellipse, and prove that the tangent of an ellipse is equally inclined to the focal distances of the point of contact.

5. The normal at a point P of an ellipse meets the major axis in G and the minor axis in G′; prove that

$$PG : PG' :: CB^2 : CA^2$$

6. The rectangles contained by the segments of two intersecting chords of a central conic are as the squares of the parallel semi-diameters.

7. If a perpendicular is drawn from the focus of a hyperbola on a tangent, the point of intersection lies in the auxiliary circle.

8. Prove, by Projection or otherwise, that in the hyperbola

$$NP^2 : AN \times NA' :: CB^2 : CA^2.$$

9. Define asymptotes of a hyperbola; and construct them geometrically when the hyperbola is given.

10. If an ellipse is defined as the section of a cone by a plane, find, by geometrical construction, the centre, foci, directrices.

11. If a circle is projected into a central conic, show that the diameters which are parallel to a pair of supplemental chords are conjugate to each other.

SECTION II.—ANALYTICAL CONICS.

12. Determine the equations to the straight lines passing through the origin, and making an angle of 45° with the line $ax + by + c = 0$.

13. Find the equations to the internal and external bisectors of the vertical angle of a triangle; and show

that the base is divided internally and externally by these lines into parts, the ratio of which is the same as that of the sides of the triangle.

14. What is the equation to the circle, passing through the origin and making given intercepts on the co-ordinate axes? find its radius and the position of its centre.

15. Define pole and polar of a circle. If the polar of the circle, $x^2 + y^2 = r^2$, is $A\,x + B\,y + C = 0$, what is the place of the pole?

16. The equation to an ellipse being $a^2\,y^2 + b^2\,x^2 = a^2\,b^2$, find the lengths of the focal distances; and hence prove that $SP \times HP = CD^2$; that is, the rectangle contained by the focal distances is equal to the square on the corresponding conjugate semi-diameter.

17. Place analytically the theorems contained in 1, 3, 5, 7 of the preceding section.

18. Show that the equation $x^{\frac{1}{2}} + y^{\frac{1}{2}} = a^{\frac{1}{2}}$ represents a parabola, and indicate by a diagram its position relatively to the co-ordinate axes.

19. Determine the equations of the principal axes and of the asymptotes of the hyperbola

$$3\,x^2 + 2\,xy - y^2 + 4 = 0.$$

NAVIGATION AND NAUTICAL ASTRONOMY.

THREE HOURS ALLOWED.

Not more than one question to be answered in each section.

I.

1. Prove that the sides and angles of the polar triangle of a spherical triangle are respectively the supplements of the angles and sides of the primitive triangle.

2. The sides of the angles of a spherical triangle are proportional to the sines of the opposite sides.

3. Prove Napier's analogies.

II.

1. State Napier's rules for the solution of a right-angled triangle, and prove them when one of the sides is taken for the middle part.

2. Perpendiculars are drawn from the angles A, B, C of any triangle, meeting the opposite sides in D, E, F respectively; show that tan. B D, tan. C E tan. A F = tan. D C tan. E A tan. F B.

3. Having given two angles and side opposite to one of them, solve the triangle.

III.

1. Required the compass course and distance from A to B, given

Lat. A 7° 18′ N. Variation $1\frac{1}{4}$ pts. E. long. A 2° 10′ W.
„ B 2° 5′ N. Deviation 2° 45′ E. „ B 2° 10′ W.

2. A ship in lat. 37° 5′ N., long. 18° 53′ W., sailed as follows:—

K. 10ths.	Courses.	Wind.	Leeway.	Variation.	Deviation.
59 5	S.S.W.	W.b.S.	Pts. $\frac{3}{4}$	Pts. $1\frac{1}{2}$ W.	5° W.
53 6	N.W.	N.b.E.	„ $\frac{1}{2}$	„ „	4° 50′ W.
62 0	E.b.S.	N.N.E.	„ 1	„ „	7° 15′ E.

Required the lat. and long. in.

3. A ship sails in a great circle from a place lat. 18° 10′ N., long. 5° 30′ W., to another, lat. 25° 27′ N., long. 16° 10′ W. Find the lat. and long. of the vertex.

IV.

1. Dec. 1, 1865, the observed mer. alt. of η Draconis under the North Pole was 30° 50′ 30″, the index error was − 1′ 45″, and the height of the eye above the sea was 19 feet. Required the latitude.

2. March 5th, 1865, at 4h. 59m. p.m. in lat. 40° 48′ N., long. 133° 30′ the obs. alt. of sun's L L. was 9° 46′ 0″ when she bore by compass S. 83° 15′ W. (ship's head S.S.W., Deviation 5° W.) Index error + 1′ 30″ and the height of the eye 20 feet. Required the variation.

V.

1. Prove that $\text{tan. course} = \dfrac{\text{Diff. long.}}{\text{Mer. diff. lat.}}$

Construct the figure for the following example—Given diff. long. = 171′ E.; mer. diff. lat. = 157′ N., to find the course.

2. Explain a Mercator's chart, and show how to find the latitude and longitude of a place on it.

3. Show how to find the latitude and longitude of the vertex when a ship sails in a great circle from one point to another.

VI.

1. June 22, in lat. by account 20° 16′ N., long. 110° 10′ E., the following observations were made:—

Mean time nearly.	Chronometer.	Obs. alt. Sun's L L.	True bearing.
9h. 30m. a.m.	2h. 39′ 21″	54° 52′ 50″	E.b.N.
2h. 13m. p.m.	7h. 22′ 19″	58° 46′ 50″	W.b.N.

The run of the ship in the interval was N.b.W. 28 miles, the index error was + 1′ 15″, and the height of the eye 16 feet. Required the latitude at the time of making the second observation.

2. Feb. 1, 1865, at 4h. 46m. p.m. in latitude 49° 10′ N., long. 4° 20′ W., the following observations were made:—

	Obs. alt. Venus, West of Meridian.	Obs. alt. Moon's LL.	Obs. dist. NL.
	36° 6′ 40″	50° 35′ 0″	27° 20′ 0″
Index error	− 1′ 15″	+ 1′ 35″	− 1′ 15″

The height of the eye was 17 feet. Required the longitude.

VII.

1. Show that the hour angle of a heavenly body = R. A. mean sun + ship mean time − R. A. heavenly body.

2. Prove the rule for finding the variation of the compass by an observed amplitude of the sun.

3. Prove that the error in the hour angle is least for a given error in the altitude when the sun is on the prime vertical.

VIII.

1. The arc of a sextant is divided into twice the number of degrees due to its length; explain by a figure the reason for this.

2. Describe the azimuth compass, and show how it is employed to observe the bearing of the sun.

3. Explain accurately all the ways you know by which the index error of a sextant may be obtained.

THE COMMITTEE OF COUNCIL ON EDUCATION.

A blue book has been published containing the report of the Committee of the Privy Council on Education to the Queen in Council for the year 1864.

During the year 1864, as compared with 1863, the number of schools, or of departments of schools under separate teachers, which were actually inspected, was increased by 588, and the number of children by 40,550. The number of certificated teachers was increased by 712. The number of new schoolhouses built was 92, comprising (besides class-rooms) 142 principal school-rooms, and 66 dwellings for teachers; 44 other schools were enlarged, improved, or furnished afresh; accommodation was created for 20,561 children, exclusive of the schools improved or newly furnished but not enlarged. The inspectors visited 11,818 daily schools or departments of such schools under separate teachers. They found present in them 1,133,291 children; 10,193 certificated teachers; 608 assistant teachers; and 11,712 apprentices. Of the schools or departments 2,231 were for boys only; 2,008 for girls only; in 5,139 boys and girls were instructed together; 1,550 were confined to infants (children under seven years of age); and 890 to night scholars. Of the children, 633,810 were males, and 499,481 were females.

The inspectors also visited 39 separate training colleges, occupied by 2,739 students in preparation for the office of schoolmaster or schoolmistress. In December last these students, and 1,757 other candidates, were simultaneously examined for the end of the first or second year of their training, or for admission, or for certificates as acting teachers.

Of the 26 reports on elementary schools by her Majesty's inspectors, which are included in this volume, two-thirds contain a decidedly favourable judgment of the working of the revised code, so far as relates to the change introduced by it into the mode of examination and payment. The less favourable judgments turn chiefly on observations of a tendency to neglect higher subjects of instruction, and to dispense with pupil-teachers.

Respecting the income of the training colleges, the committee observes:—"We cannot help noticing that out of an income (1864) of £121,241, to which the State contributed £96,166, for the support of the 39 training colleges inspected, only £41 18s. 10d. is returned as derived from collections in churches and chapels. If an annual sermon were preached in each church or chapel of the diocese, or religious communion, with which each college is connected, on behalf of its funds, these institutions would become better known to the public, and might obtain more general support."

WORKING MEN'S CLUB AND INSTITUTE UNION.

The annual meeting of this institution was held on Monday, 2nd inst., in the Lower-hall, Exeter-hall; Lord Brougham in the chair. The report, which was read by the secretary, the Rev. Henry Solly, stated that 41 new clubs and institutes had been established during the past year under the impulse and guidance of the union, which, added to the number previously established, made a total of 116 clubs formed by the union during about two years and a half of active operation. From a return which had been received from about half of the clubs in the kingdom, it appeared that they numbered 14.667 ordinary members and 958 hon. members—the average number of members to each club being 228 ordinary and about 13 hon. members. Therefore if the remaining 70 or 80 societies which had not sent in returns contained about the same number, there would be a total of about 30,000 ordinary and nearly 2,000 hon. members in the clubs and institutes of Great Britain. Throughout the country and in the metropolis new clubs were being organised, but in South London and Bethnal-green, where they were pre-eminently needed, greater difficulty and delay in forming them had been experienced than in almost any part of the country, mainly owing to the want of resident local gentry. The financial statement showed the receipts, including balance of £92, and donations £1,125, to amount to £1,609, and the expenditure to £1,470, leaving a balance of £139 in hand. The meeting was addressed by Lord Lyttelton, Lord Ebury, Mr. Layard, M.P., Dr. Bowkett, Mr. Bainbridge, Mr. Vyse, Mr. Marriatt, and others, and resolutions were passed adopting the report, re-electing the officers, acknowledging the importance of the operations of the union, and appealing for increased and more regular public support.

At the conclusion of the business, Lord Brougham said that the object of this important movement was to give to the working man an opportunity of combining amusement with his work, and spending one or two of his spare hours in the evening in a manner which, whilst harmless, would prove highly profitable to himself. A working man, by the establishment of these clubs, was relieved from the necessity, which in many cases was a most disagreeable one, of having company at his own home, where he could ill accommodate a friend for an hour, as he could now, without the slightest inconvenience, enjoy the conversation of his fellow workmen and the amusements which were there provided for him. A friend of his from Carlisle had stated that the working men's club at that place had proved a failure, but he (the noble lord) had discovered that the failure was consequent upon the club taking simply the form of a reading room. A reading room was undoubtedly an excellent thing, but the other characteristics of a club must be joined with it to render it successful. It had been said that there was a slowness on the part of the working men to join the clubs, but that, he thought, must arise from the fact that they had not had their operations and advantages sufficiently explained. He was certain that if that were clearly and properly done, the working men would not be slow to take advantage of the suggestions offered to them. A great change had taken place during late years, beginning at Rochdale and extending over Lancashire and Yorkshire; in fact, over the greater part of the north of England—he meant the system of co-operation, which was now becoming such a great power in this country. The co-operative system was most important to the working man, inasmuch as it tended to better his position in every respect, and he had no reason to suppose that the working classes themselves would not look upon it in that light, and that the clubs and institutes which had been established would not be warmly supported by them.

A vote of thanks having been accorded to the noble lord, the proceedings terminated.

Manufactures.

Silkworm Disease in France.—An error occurred in the notice on this subject in the *Journal* of the 30th of June, page 542. In the report in the *Moniteur* the quantity of eggs or seed required annually in France was incorrectly given; the actual quantity required annually is thirty thousand kilogrammes, or thirty-three tons.

Another New Kind of Writing-ink.—M. Mathieu Plessy, of Paris, manufacturer of pyrogallic acid for photographic purposes, has invented a new ink, which is said to be composed of a mixture of the products of his factory with the colouring matter of dye woods. It is said to possess all the qualities of the best ink, and to be entirely free from their common faults, not liable to form deposits, or to become thick and mouldy, to flow with great freedom, and to dry on the paper almost instantaneously.

Public Workshops for Artisans.—At a recent weekly sitting of the St. Marylebone Vestry, an important discussion arose, on a motion by Dr. Richardson, to invite all the other metropolitan vestries to elect two members each, with their medical officer of health, to consider the desirability of taking steps for the erection of public workshops in the various parishes, for the accommodation of artisans, who at present worked in their own small and crowded houses and rooms, and as to the propriety of obtaining an Act for the establishment of such workshops, similar to the "Baths and Wash-houses Act."—Dr. Richardson said he had brought forward this subject on sanitary, moral, and social grounds. With respect to the first, he was prepared to prove that epidemics were frightfully increased, and even introduced, into families of the upper classes, through clothes being made in crowded rooms, where fever prevailed. Many poor men, overwhelmed with debt, were unable to provide proper places for their labour, and consequently could not do their work in a proper manner, whilst others had no conveniences for pursuing their avocations at all.—Mr. Filmer opposed the motion, on the ground that, though the proposal might be an excellent one, brought forward as a public institution, or started by a limited liability company, he really thought it was one quite beyond the province of a parochial board.—After some further discussion, the motion was negatived.

The Cologne Exhibition.—The following is a list of prizes and distinctions awarded to British exhibitors:—To the Fowler's Steam Plough Company (Limited), the

first prize of £150, for the best steam plough, and £75 for the best traction engine; to Messrs. Mereweather and Sons, London, the first prize of £75, for the best steam fire engine; to Messrs. Shand and Mason, London, a gold medal for ditto; to Messrs. Clayton and Shuttleworth, Lincoln, a gold medal for steam engine and thrashing machine; to Messrs. Hornsbys, of Grantham, gold medal for ditto; to Messrs. Ransomes and Sims, of Ipswich, gold medal for ditto; to Messrs. Garrett and Sons, Leiston-Saxmundham, gold medal for ditto; to Messrs. Smyth and Sons, Peasenhall, gold medal for drills; to Messrs. Russell and Sons, Wednesbury, gold medal for tubes. The jurors also award silver medals to the following firms:—Robey and Co., Lincoln, for threshing machine and engine; Bentall, of Heybridge, for chaff machines, &c.; Mr. Kent, London, for domestic contrivances; Mr. Nicholson, of Newark, for horse rake; Messrs. Furness, Ipswich, for steam engine, threshing machine, and mills; the Reading Iron Works, Reading, for steam engine, threshing machine, and horse works; Mr. Robert Boby, Bury St. Edmunds, for patent self-cleaning corn screens, and for patent double-action haymaking machine; Ruston and Proctor, Lincoln, for steam engine and threshing machine; Burgess and Key, London, for reaping machine; Messrs. Samuelson and Co., Banbury, for mowing machines; Woods and Cocksedge, for bean mill. Bronze medals are awarded to Messrs. Webb and Sons, Stowmarket, for the best leather driving bands; to Powis and Co., London, for steam sawing machinery; to Barrett and Co., Thirsk, for reaper; to Kemp, Murray, and Co., Stirling, for reaper; Gwynn and Co., London, for centrifugal pumps. Honourable mention to Mr. Goodcher, Worksop, for threshing machine beaters. This list, in which almost all the first and most important prizes awarded in the agricultural machine department are included, shows sufficiently that Great Britain still maintains her superiority over the rest of the world in this department.

Commerce.

Chemists and Druggists.—The following is the report of the select committee of the House of Commons to whom were referred the Chemists and Druggists Bill, and the Chemists and Druggists (No 2.) Bill:—"Your committee have examined witnesses on the general questions raised by the provisions contained in the two bills committed to them, and have heard evidence in support of the Chemists and Druggists (No. 1) Bill. Your committee then passed the following resolutions:—1. That no compulsory examination or registration under the bills referred to the committee should be required of persons now carrying on the trade of chemists and druggists. 2. That the bill do provide that no other person shall, after a day to be fixed by the bill, sell certain dangerous drugs, to be scheduled in the bill, unless he shall be examined and registered. By the adoption of the second resolution as an amendment to a proposal that persons compounding medicines from the prescriptions of medical men should also be examined, your committee decided against the principal provision contained in the Chemists and druggists (No. 1) Bill, and they accordingly resolved to proceed with the Chemists and Druggists (No. 2.) Bill. After several clauses of the bill were passed, considerable difficulty arose in providing for the first formation of the council to which the duty of regulating the examination of chemists and druggists was to be intrusted; and your committee, considering the advanced period of the session, were compelled to abandon the expectation of any useful result from a further consideration of the bill. Having, therefore, disposed *pro forma*, of the remaining clauses, they came to the following resolution:—'That inasmuch as there appears to be little prospect of any satisfactory termination to the labours of the committee in the present session, it is desirable that the evidence, so far as it has been already taken, and the proceedings of the committee, be reported to the house, accompanied by a recommendation that the government should, early in the new parliament, bring in a bill on the subject referred to the committee. Your committee have in conclusion to report that, in their opinion, it is not expedient to proceed further with either of the bills which have been committed to them."

Colonies.

Railways in Victoria.—The expressed intention of the Government to lease the Victorian railways as soon as they should have received sufficient information from home to enable them to see their way clearly, is the natural result of the expensive manner in which the arterial trunk lines have been executed. Similar extravagance seems to have prevailed in New South Wales. Instead of starting, as would appear reasonable, from the head of the river navigation, the only two lines at present in working order from Sydney to Newcastle, lie, for the greater part of the way, side by side with a navigable tideway, and the available money has been already nearly exhausted at the time they have run themselves to a stand still among the intricacies of the Blue Mountains. It is difficult to say what number of years may be requisite to carry the Goulburn and Penrith lines effectually across the highlands into the level of Riverina. The actual cost of the Great Southern Railway from Parramatta Junction to Picton, and estimated cost from Picton to Goulburn, are given at £1,397,799. The actual cost of the Great Western Railway from the Parramatta Junction to Penrith, and estimated cost from Penrith to Bathurst at £146,852; sums which are indeed at a reduced rate from those of Victoria, but which New South Wales has far less power of meeting. The case of Victoria is not so desperate, but it is more owing to the facilities of the terrain than any superior wisdom. If the pass through which the line reaches Sandhurst had presented the same natural difficulties as the tangled precipices beyond Picton and Menangele, the terminus would never now have rested on the Murray. As it is favoured by the fortunate depression in the dividing range, it has reached both Echucea and Ballarat, but at a cost of eight millions. Against £404 808 which is set down as interest for the loan, and £116,912 working expenses, collectively £521,720, the receipts for the year 1864 amounted to £480,332, showing a deficiency of £41,388. A colonial journal says:—"Experience has shown that Government railways are exposed to the same encumbrances which make the greater number of public undertakings far more expensive than private ones. Paid officials at fixed salaries will never work as efficiently and cheaply as individuals whose profit depends upon their success. They likewise offer an enormous field for political jobbery."

Cotton Cultivation in Queensland.—It is now become a general belief that cotton will thrive best when grown on land which has been a few years under cultivation, and that it is not the best crop to put in new ground. One of the principal growers in this colony has left a considerable quantity of his last year's crop of Sea Island in, to test the opinion generally expressed—that there is no need to sow every year, but so far he is not content with the result. He is of opinion that the time saved in planting is not equivalent to the great advantage of loosening and turning the soil, which is, of course, impossible when the plants are left in the ground. He has about fifty acres altogether under crop, and he hopes not to have less than a bale per acre. This is the last season that the larger sum of £10 per bale premium is given by Government, but is to be hoped that this will be extended another season or two. The Manchester Queensland Cotton Company has cleared 344 acres, of

which 121 acres are under New Orleans cotton, which looks well and promises to yield a good crop. The area under Sea Island consists of 33 acres, of which 15 are plants of last year, which have been pruned. These are loaded with bolls, and the quality is fully equal to that sold last year at 4s. 6d. per lb. Three bales have already been picked, and it is estimated that the yield will average one bale per acre. The total area under cultivation is 154 acres, not quite so many as last year, but promising much more satisfactory results.

FISH IN VICTORIA.—The extent of the Victoria fishing ground is immense. In Port Philip Bay there is an area of over 700 square miles, with a coast line of about 130 miles, well supplied with fish; and in Western Port Bay about 300 square miles, one immense fishing ground, and still more plentifully supplied with better fish, and with a coast line of 120 miles, including French and Phillip Islands. Both bays are landlocked, and in every way favourable for fishing. The following are the descriptions of fish found in these bays. Schnapper, from 2 lbs. to 20 lbs., even 30 lbs.; rock cod, flat head, garfish, whiting, silver fish, mullet, gurnet, ling, perch, mackerel, butter fish, 10 lbs. to 20 lbs.; salmon trout, white salmon, bream, plaice, flounders, and kingfish, also crayfish, shrimps, and oysters. There is one immense bank, extending south and east from the eastern entrance of Western Port, swarming with schnapper, rock cod, and other fine fish, that would of itself, even as far as now known, supply a large fishery. It has been ascertained that the banks extending to the eastward of King's Island, Rabbit Island, and Dorner Inlet, besides butterfish, jewfish, and others, abound in flounders of large size and of the finest quality; and as the straits average less than 45 fathoms, and with much sand and shell bottom, most favourable for trawling, it is only requisite to have proper boats to give as ample a supply in winter as in summer.

MINES IN SOUTH AUSTRALIA.—There are now seven working mines on the peninsula, nearly all of which may be said to be paying mines, viz., Moonta, Wallaroo, New Cornwall, Yelta, Karkarilla, Kurilla, and South Wallaroo. The Moonta is probably the richest mine in the world, standing almost unrivalled for the richness of its mineral deposits. It is stated that the monthly produce of ore varies from 1,500 to 1,800 tons, worth at least 20 per cent. of pure copper. Very rich black ore is also being raised from the mine, besides sulphides and carbonates of various per centages. Next in importance stands the Wallaroo mine, near Kadina, the quantity of ore raised from which nearly equals that of the Moonta, but the quality is inferior by 5 to 7 per cent. A large accession of strength has lately been received at this mine, sixty men, with their families, having just arrived from England.

SHEEP-FARMING IN VICTORIA.—Opinions are said to be changing as to the feeding capabilities of this country, and this principally because of the fencing and subdividing so many sheep-runs, as well as of the necessity for keeping small flocks by farmers on limited spaces of ground. Where the old system of shepherding on the open pasture is still followed there has been little or no improvement in this respect, but even by fencing alone the feeding capabilities of any tract of land are vastly increased. When driven to-and-fro in large numbers, the sheep trample under foot and destroy as much as they eat, and much of the food they do get is wasted in the exertion of walking much further than they otherwise would, and, when grass is scarce, in racing a-head for the little that is to be picked up, and when allowed to follow their own inclination, as they are within fences, there is no hurry or racing, no more travelling than is actually necessary, and little or no grass is so trampled upon as to be wasted. The loss from driving alone, even by the most careful shepherds, is considerable, and should not be overlooked in calculating the advantages of fencing-in a run. Thus, in estimating these the saving of wages is but a trifling benefit gained in comparison with the saving of grass and the consequent increase in the number of sheep the same extent of ground will keep. The grazing capabilities of many of the runs have been doubled by fencing alone; land which before only kept one sheep to two acres, is now a sheep per acre, and keeping them in better condition throughout the year, while on limited portions of the best land, well subdivided, even two or three sheep to the acre are kept all the year round, or nearly so, and this on the natural grasses, improved only by the long feeding down and manuring of the sheep kept thereon. The gradual introduction of English grasses and clover has helped materially, in places, towards this improvement, but these do not spread much except when the land has been broken up.

Obituary.

ANTOINE JOSEPH WIERTZ, painter, sculptor, and writer, born at Dinant, in Belgium, in 1806, died at Brussels last week. He was a pupil of Van Brée, and won the grand prize of the Belgian Academy in 1822. He executed a large number of large historical works of importance, and wrote, amongst other things, "Memoirs of the Life of Rubens."

NILS ANDERSON. Professor of Painting in the Academy of Stockholm, died recently at the age of forty-six. He studied for some years under M. Couture, of Paris, and afterwards founded a school in Stockholm, which has produced many distinguished painters.

Publications Issued.

L'ASTRONOMIE AU XIX^{ME}. SIECLE. Par M. A. Boillot. 1 vol., 12mo. (*Paris: Didier and Cie.*) A carefully executed history of the progress of astronomical science from the earliest period to the present day, by a mathematical professor who is also scientific editor of the *Moniteur Universel*, and contained in a single volume of small size. The work is intended for general readers, contains all the principal facts relative to the subject which it treats, is clear of technicalities, is written in a lucid, pleasing style, and exhibits the utmost impartiality in treating of the labours and discoveries of the astronomers of foreign nations. In fact the English element is very prominent in M. Boillot's book: he not only does full justice to Newton, Flamstead, Halley, Bradley, Captain Cook, the Herschels, Hind, Airy, Nasmyth, Lord Rosse, and other Englishmen, but the entire volume shows that M. Boillot is very conversant with both the literature and science of our own country. The first chapter contains a short sketch of the labours and notions of the old astrologers, which will be very welcome to the general reader. Of Newton, M. Boillot speaks with the greatest enthusiasm:—"The great Newton, the creative mind, the precise thinker, and fruitful genius, meditating on Kepler's law and on the special movements of the moon, was dissatisfied with the result with which the science of his day furnished him. He saw that the force then called *weight* or *heaviness* might well extend to the moon, and he verified the truth of his idea. His mind, stimulated by this first success, assumed increased activity, and finished by dissipating all the clouds that had obscured the view of the grandest scientific discovery that was ever made—the principle of universal attraction." The chapter which records the services that have been performed for astronomical science by the combined efforts of the Observatories of Paris and Greenwich, aided by the astronomers of other countries, during the last ten years, and the observations on the consequences of the spectral analysis, are full of interest.

ANNUAIRE DE L'ECONOMIE POLITIQUE ET DE LA STATISTIQUE. By Maurice Block. 1865. (*Guillaumin and Cie, Paris.*)—This modest annual, now in its twenty-

second year, contains a vast amount of information, well arranged and well printed, in a handy form, and at a moderate price. It is divided into four parts, the first treating of France in general, the second of Paris in particular, the third of Algeria and the colonies—a new feature, introduced for the first time this year—and the fourth of foreign states, besides supplementary matter. The wonderful changes which the city of Paris and the Department of the Seine have undergone during the last twelve or fifteen years, and which are still in progress, give a peculiar interest to that portion of the work which treats of the metropolis. We find the ordinary receipts of the municipality for 1864 set down at very nearly a hundred and twenty millions of francs, and estimated for the current year at rather over a hundred and thirty millions of francs. The principal items are the following:—Octroi duties, paid at the barriers of the city on articles of ordinary consumption such as food, wine, oil, fuel, &c., upwards of eighty-eight millions; market dues, nearly eight millions; water-works, five millions and a-half. In addition there are further ordinary, supplementary, and extraordinary receipts, making up the grand total revenue of the municipality to upwards of one hundred and fifty-five and a half millions. The estimates are made to balance, so that the same sum represents the expenditure. The population of the city was, in 1861, 1,696,141, and the annual increase since, about 7,500 per annum, making a total of rather less than a million and three-quarters for the current year. If we divide the gross total of the above estimate by the total number of the inhabitants of Paris, we find that the expenditure is equal to rather more than eighty francs, or full £3 11s. per head. In the year 1863, the total of all expenses—ordinary, extraordinary, and supplemental—amounted to very nearly two hundred and ten millions of francs, or, on an average, very nearly £5 per head. These figures are derived from the published reports of the Prefect of the Seine, and it must be remembered that they represent the municipal expenditure alone, exclusive of the general taxation of the empire. The ordinary expenditure of the current year is set down at equal to £3,385,845, the principal items being, in round numbers:—Annual interest on municipal debt, £537,150; expenses of the prefecture and twenty mairies, £124,000; collection of octroi dues, £310,000; National Guard, Gardes de Paris, &c., nearly £120,000; charitable institutions, £411,879; primary instruction, £178,924; survey and plan of Paris, £69,436; roads and quarries, £679,176; water and sewers, £103,288; promenades and plantations, £115,440; police, £495,573. The extraordinary and supplementary expenditure is estimated at equal to £2,837,756, of which sum £412,596 is devoted to further interest and charges on the city debt, and the greater portion of the remainder to the improvements and embellishments of the capital, the reconstruction of the abattoirs, and the completion of the roads and other works in those parts of the former *banlieues* which now form integral portions of the city. As regards the amount of indigence in Paris, the returns make a very satisfactory appearance. In 1832, it seems there was one person receiving public assistance to every 11·16 of the population; in 1838, it had fallen to one in 15·37; between that period and 1847 it had risen again to one in 13 or 14; in 1850, it had fallen to one in 16·38; and in 1851 it was only one in 18·47. The total number receiving relief in that year was 101,570, and the sum distributed was equal to £168,000, of which one-fourth was derived from testamentary and voluntary contributions. Deducting from this total the amount expended in medical assistance rendered at the homes of the poor, it appears that on an average each person relieved received about 27s., or three times as much as the average in the tenth year of the first republic. The number of houses demolished and constructed during the twelvemonth ending with September, 1864 in Paris, was as follows:—1,383 demolished, of which 271 were in consequence of municipal improvement, and 3,098 erected, leaving a balance of 1,715 houses, or 15,676 sets of apartments, number corresponding to a population of about 45,000 persons. The total increase in the number of apartments created, by demolition and reconstruction, to September last is given at 629,421, by far the larger portion being in the new or outlying districts of the city, such as those of Popincourt, the Gobelins, the Observatory, Vaugirard, Passy, Batignolles, Montmartre, the Buttes Chaumont and Menilmontant. The chapter relative to Algeria and the colonies informs us that the European population of Algeria, which only numbered 700 in 1830, had risen to 37,374 in 1841, and to 213,061 in 1863; in the year 1862 the French subjects numbered 118,804, and the natives of the European States 86,073; but the per centage of increase is in favour of the latter, although the actual increase is slightly on the side of the French immigration. The French army in Algeria amounted in 1861 to 63,786, and the civilians employed, and not included in the general population given above, to 13,140, or together equal to about 40 per cent. of the colonial population. At the same period the native population was about five millions and a-half. As regards commerce the returns are not encouraging, for the total of imports and exports had fallen from 167 millions of francs in 1858 to less than 139½ millions in 1862. There was, however, an increase of about 40 per cent. in the exports of 1863, with a slight diminution of the imports. A comparative table of the mercantile marine of the world will be interesting to English readers. It appears that while in Belgium there exists but one ton of shipping for every 162 inhabitants, the ratio in France is 1 in 38; in Spain, 1 in 18.4; in Sweden, 1 in 9·9; in the United States, 1 in 6·1; in England and in Holland, 1 in 5·5; in Greece, 1 in 4; in Norway, 1 in 2·1; in Hamburg and the three Free Cities, 1 in 0·9; and in Bremen, 1 in 0·6.

Forthcoming Publications.

Art Foliage. By James K. Colling, F.R.I.B.A.—The work will be divided into three parts, and consist of—1. An analysis of form, being a selection from the best and most useful geometrical ornaments, which have been used for decoration in the various periods of art, and in different parts of the globe, with an analytical description and comparison of their various combinations. 2. A series of studies from natural foliage—in the branch, the bud, the leaf, the flower, and the fruit—accompanied by letter-press description and wood-cuts. 3. A series of original designs for foliated enrichments suited to the various branches of the ornamental arts, including stone and wood carving, painted decoration, inlaying in wood, stone, and marble, wall papers, metal work, &c., accompanied by a detailed description of each plate, explaining the sources from which the designs have been derived, and an endeavour to elucidate the principles which should guide the artist in designing from nature; the primary object being to show how natural form was idealised by ancient and mediæval artists, and in what manner the same sources may be again appealed to, to gain new beauty and fresh inspiration.

Notes.

The Philadelphia Sketch Club offer a prize of 2,000 dollars for the finest work of art illustrative of the great American rebellion. Contributors must be, at the time that they send in their contributions, residents of the United States.

French Academy of Inscriptions and Belles-Lettres.—The numismatic prize of this Academy, founded by M. Allier de Hauteroche, has been awarded to Mr. John Evans, for his work, published last year in London, on the coins of the Ancient Britons.

Paris Universal Exhibition of 1867.—The *minimum* amount of guarantee having been subscribed for, the Imperial Commission has added nineteen members to its body, as representatives of the guarantors provided for in the original decree. The list includes several names well known in the financial and industrial world, as, for instance, Messrs. E. Pereire, P. Talbot, the Duc d'Albuféra, Baron James de Rothschild, Sallandrouze de Lamornaix fils, Desfosses, and Halphen.

Great Prize in Voltaic Electricity.—The French Government has just announced the renewal of the grand prize of 50,000 francs to be given, in five years' time, to the author of a discovery which shall render the voltaic pile economically applicable as a source of heat, as a means of lighting, or otherwise, in chemistry, mechanics, or medicine. This prize was awarded, in September last, to M. Ruhmkorff, for the well-known apparatus which bears his name. In case no invention deemed worthy of the honour should be brought forward within the time specified, the period may be prolonged for another five years by decree. The prize is, we believe, open to all the world, but it is not so stated.

Cost of Great Drainage Works.—In consequence of the terrible disasters which occurred in 1856, when the whole of the great basins of France were inundated, a careful inquiry and surveys were made, and in 1858 a law was passed for the carrying out such works as should insure the towns which had suffered most against future inundations. Works have been executed with that view in forty-five towns, at an outlay of twenty-two millions of francs, or £880,000. As regards the great valleys, the Imperial Government appointed an inspector-general for those of the Seine, the Loire, the Rhone, and the Garonne, and the result of all the surveys and inquiries that have been made was made known to the Corps Legislatif by M. Franqueville, the government commissioner, in the following words:—"Are you aware, gentlemen, what it would cost to reduce the level of the waters in these valleys, say two or three feet, during great inundations? For the valley of the Loire it would require eighty-five reservoirs, which would cost a hundred millions of francs (four millions sterling), and the same for that of the Rhone. We have not dared to undertake such an enterprise, to ask the country to make such sacrifices in order to prevent a misfortune that only occurs two or three times in a century." The valley of the Rhone was inundated in the years 1840, 1841, and 1856, and that of the Loire in 1846 and 1856. The opinion of those who have inquired into the subject is that such inundations cannot be attributed to any changes that may be made in the quantity or distribution of timber in the localities, but that the facts observed during eight or ten centuries prove that they are the result of a concurrence of a certain number of atmospheric circumstances which fortunately happens but seldom. Another conviction forced upon the Government engineers is that the plans proposed are of very questionable efficiency, and upon this head a report is promised of the results of all the examinations that have taken place under the general council of engineers having charge of the roads and bridges of the empire.

Local Railways.—A very important problem, that of branch railroads connecting small places with each other, and with the main lines, is being resolved in France. The honour of the initiative belongs to the department of the Bas-Rhin, whose Conseil-Général, in 1858, came to the determination that it was desirable to create a second series of roads uniting the principal places in each commune, and to offer these to companies or local speculators for the formation of railroads. There was, however, considerable opposition, one party objecting that the funds of the road trust, as it would be called in England, could not properly be applied to the formation of roads to be converted into railways, and another, that local railroads were the mere dreams of theorists. Last year, however, the project obtained the support of the Ministers of State and of Agriculture, M. Rouher and M. Behic, who supported the proposal in the Conseils Généraux of the Puy-de-Dôme and of the Bouches-du-Rhône. The prefect of the Bas-Rhin had, in the meantime, pushed forward his scheme, and in 1859 he obtained the sanction of the departmental authorities. He then opened up correspondence with the Great Eastern Railway of France, but the negociations ended in nothing, and it was determined to form local companies for the purpose, and in 1861 a supplementary tax of twenty-six centimes (about a shilling in the pound), extending from 1861 to 1871, was made for the special purpose, and the work was commenced. On the 25th September, 1864, the first of these departmental lines, about forty-seven miles in length, was opened for traffic. The government recognised the importance of the new movement, the ministers of the interior and of commerce determined on framing a special law upon the subject, and a commission issued from the office of the latter minister to collect full information upon the subject. The example of the Bas-Rhin was soon imitated by its neighbour, the department of Haut-Rhin, in which a line from Hagueneau to Niederbroun was opened on the 18th, and another from Sainte Marie-aux-Mines to Schelestadt on the 29th of December last. The department of Sarthe has voted the means for carrying out three such local lines. Ain, which is very badly off as regards railway communication, is now engaged on the question; and several other departments have adopted the idea and are now occupied with its realisation. In that of the Seine-inférieure surveys are being made for a line to connect St. Valery-en-Caux with the Rouen and Havre railway, and which is intended to form part of a complete system which will unite the whole of the small places on that coast with the trunk line in question. The results, in a financial point of view, can only be guessed at by the short experience of the line in the Bas-Rhin; this road was opened for passengers on the 25th of September, and for heavy traffic, in part, on the 24th October, and completely on the 29th December last, when the weather was very bad, and the conditions consequently disadvantageous. The total receipts, from the 27th September to the 31st December, were equal to £2,939, or, on an average, of £320 for little more than $\frac{6}{10}$ of a mile. The profit resulting is given at 2,000 francs per kilomètre, or about £130 per English mile. The nature of the traffic is a very important question. The Barr line has fifteen stations, that is to say, one for each commune; this was used by 70,000 persons, who paid a total of 60,293 francs, or, on an average, 86 centimes per passenger. This is tolerably conclusive evidence that the traffic of the line was eminently local and independent of the general railway traffic of the country. There is another proof in the fact that the total of arrivals and departures at the station of Strasbourg, on the main line, during the same period, was only 47,768, which leaves 22,232 for the purely local circulation, without taking into account those which may have travelled for local purposes between the chief town and intermediate stations on the truuk line. It is not intended that great speed should be attained on these local lines, and therefore the question of curves and gradients becomes of smaller importance. In the Haute-Marne the minimum radius is fixed at 250 mètres; in the Indre it has been set at 300. The inclines adopted in the Haute-Marne vary from 0·02 to 0·018 per mètre. Lastly, some of the local lines will be worked by horses, while the engines and carriages employed on the others are of a smaller and less costly kind than those used on the main lines. In the Bas-Rhin the expense of the new roads has been 45,000 francs per kilomètre, while it has cost the Great Eastern Company, which has become the *concessionaire* of the line, 60,000 francs per kilomètre to convert the new roads into railroads and provide machinery and material. Thus the total cost of these local lines may be taken roughly at an average of 115,000 francs per kilomètre, while the Paris and Orleans cost 368,000 francs, and the Rouen line 404,000 francs per kilomètre. It is not easy to exaggerate the results which may arise

from the complete carrying out of this system of rural railways, and any fact connected with it is of importance.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Num. *Delivered on 17th and 19th June, 1865.*

209. Bills—Local Government Supplemental (No. 5).
217. ,, Record of Title (Ireland) (as amended in Committee).
218. ,, Poor Law Board Continuance, &c. (as amended in Committee).
219. Peace Preservation (Ireland) Act (1856) Amendment.
220. ,, Salmon Fishery Act (1861) Amendment (as amended by the Select Committee, and on Re-commitment).
221. ,, Sewage Utilization—Lords Amendments.
222. ,, Pier and Harbour Orders Confirmation (No. 2) (as amended in Committee).
223. ,, Pier and Harbour Orders Confirmation (No. 3) (as amended in Committee).
224. ,, Carriers Act Amendment.
66 (x). Railway and Canal Bills—Eleventh Report of the General Committee.
202. County Treasurers—Abstract of Accounts.
266 (II). Oaths and Declarations—Returns.
321. Freeholders (Ireland)—Return.
351. Rivers Pollution—Commission.
354. Education (Ireland)—Annual Report.
364. Revenue and Expenditure—Statements.
366. Vessels not Armour-Plated—Return.
367. Iron-Plated Ships and Batteries—Return.
371. Advances for New Courts of Justice and Offices (1865-66).
372. Navy—Supplementary Estimate (Greenwich Hospital).

Delivered on 20th June, 1865.

216. Bills—Harbour Transfer.
225. ,, Turnpike Trusts Arrangements.
226. ,, Colonial Docks Loans.
227. ,, Turnpike Acts Continuance.
145 (I). Tithe Commutation—Further Return.
322. Grand Jury Presentments (Ireland)—Abstract of Accounts of Presentment.
Abyssinia—Papers relating to the Imprisonment of British Subjects.
Canada—Papers relating to the late Conference.

Delivered on 21st June, 1865.

229. Bills—Sheep and Cattle—Lords Amendments.
230. ,, Fire Brigade (Metropolis) (as amended in Committee).
315. Elmswell, &c., Schools—Return.
362. Vessels and Tonnage—Return.
365. Coals (Woolwich and Portsmouth)—Return.
North America, No. 6 (1865)—Correspondence respecting the Cessation of the Civil War.
North America, No. 7 (1865)—Correspondence respecting the Proclamation issued by the President.
New Zealand—Further Papers (2nd June).
Spain and France—Correspondence respecting alleged Commercial Negotiations.

Delivered on 22nd June, 1865.

228. Bills—Comptroller of the Exchequer and Public Audit (as amended in Committee).
331. Shipping—Return.
353. New Ross Union, &c.—Returns.
379. Dockyards and Steam Factories—Return.
389. Thames Embankment—Correspondence.

Delivered on 23rd June, 1865.

233. Bill—Compound Spirits Warehousing.
234. ,, Indemnity.
235. ,, Expiring Laws Continuance.
378. Registry of Deeds Office (Dublin)—Returns.
386. Waterford and Limerick, &c., Railways—Return.
392. Civil Service Estimates—General Abstract.
393. Referees on Private Bills—Report from the Select Committee.

Delivered on 27th June, 1865.

352. Capital Offences (Ireland)—Return.
363. Land Tax—Returns.
385. Treasure Trove—Return.
369. Thames Embankment—Correspondence.
393. Referees on Private Bills—Report and Evidence.
402. Tenure and Improvement of Land (Ireland) Act—Report from the Select Committee.
409. Constabulary (Ireland)—Contract.
411. Mont Cenis Railway—Report from Captain Tyler, R.E.
Western Australia and Tasmania—Annual Reports on Convict Establishments.

Patents.

From Commissioners of Patents Journal, June 30th.

GRANTS OF PROVISIONAL PROTECTION.

Artificial fuel—1600—C. J. Collins.
Bottles and stoppers—1570—H. B. Fox.
Boilers, multitubular—1614—H. Ormson.
Buildings, partitions, roofs, &c., of—1598—J. J. Bodmer.
Carriages, break for—1604—J. Griffiths.
Carriage windows, arrangements for opening and shutting—1613—S. Courthauld and C. W. Atkinson.
Coal, &c., machinery for compressing—1606—H. G. Fairburn.
Collars and cuffs, machine for curling or curving—1589—G. Speight.
Cotton-spinning—1574—J. de Hemptinne.
Doors and windows, &c., fastenings for—1578—G. E. Meek and W. H. Howes.
Doors and windows, apparatus for maintaining in position when open, and for securing when shut—1581—A. H. Gilmore.
Fibrous materials, apparatus for printing—1580—J. Henderson.
Fibrous substances, preparing and spinning—1565—S. Stell, T. Broughton, and R. Hunter.
Furnaces—1590—R. A. Brooman.
Fire-arms, breech-loading—1562—J. R. Cooper.
Frames for looking glasses—1564—H. Hunt and R. Hunter.
Fuses for shells for ordnance—1595—G. Haseltine.
Gas, purification of—1591—J. Thomas.
Hammers, steam—1607—B. and S. Massey.
Iron and steel manufacture, apparatus used in—1506—H. Allman.
Iron ships, sheathing—1612—W. R. Mulley.
Kilns for firing porcelain—1582—R. A. Brooman.
Leather and fabrics, ornamenting—1389—W. Clark.
Locomotive engines, &c.—1601—J. H. Johnson.
Metals, machinery for cutting—1571—W. W. Hulse.
Paper manufacture—1602—T. Routledge.
Paper manufacture—1596—J. A. Millington and A. Allnutt.
Paraffin, purifying—1586—G. E. Poynter.
Phthalic acid and chloroxynaphthalic acid—1605—F. A. Laurent and J. Casthelaz.
Railway signals—1603—E. S. Horridge.
Rocks, cutting and excavating—1587—G. Haseltine.
Safety valves—1575—C. Vernon and W. Hodgkins.
Sewing machines—1566—J. Draper.
Sewing machines—1584—J. Glazebrook and M. N. and B. R. Mills.
Sewing machines—1592—J. Hayes.
Sewing machines—1611—G. E. and J. Keats.
Ships, sheathing the bottoms of—1567—B. S. Cohen.
Splints for fractures—1597—C. A. Hemingway.
Steering apparatus for ships and vessels—1577—W. H. Harfield.
Ships' cables, apparatus for stopping and easing—1608—C. de Vendeuvre.
Tea, firing and curing—1594—A. Robinson.
Traps for rabbit-catching—1375—R. T. Birt.
Wickets for the game of cricket—1478—W. H. Stanley.
Wood, impregnating with various substances—1573—W. E. Gedge.

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

Nails for horse-shoes—1693—P. A. le Comte de Fontainemoreau.
Sewing machines—1678—G. Haseltine.

PATENTS SEALED.

15. L. D'Aubréville.	42. J. Lebaudy.
17. L. Goldberg.	61. T. Horrex.
18. G. Hodson and J. Pitt.	83. H. Coutanche.
23. W. Ager.	101. F. Barnes, D. Hancock, and E. Cowpe.
24. D. Verrichio.	139. J. S. Edge.
32. J. W. Branford.	831. T. Farmer.
33. J. M. Kirby.	996. W., E., and J. Gray.
34. J. Skelton.	

From Commissioners of Patents Journal, July 4th.

PATENTS SEALED.

28. W. H. Roy.	129. F. C. Fourgeau.
40. J. E. Vigoulète.	138. G. T. Bousfield.
47. W. C. Thurgar.	143. J. Robinson.
55. G. B. Galloway.	177. W. Clark.
56. B. W. Bentley.	214. C. Roques.
60. J. J. Blackham.	236. C. D. Abel.
63. A. Barlow.	318. R. Richardson.
64. J. H. Johnson.	323. E. and T. Williams.
68. W. Davies.	329. W. Cockburn.
70. B. P. Bidder.	483. J. H. Johnson.
71. F. Wiese.	486. W. E. Newton.
74. J. C. Brown.	977. C. H. Williams.
84. A. F. Lendy.	1060. J. Rippon.
100. W. Russ.	1067. C. R. Fisher.
106. G. H. Daw.	1117. W. Scarratt.
111. W. Brookes.	1263. S. Bennett.
119. G. Davies.	1271. W. Clark.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1876. J. Parkes.	1918. C. Lungley.
1912. W. Easton.	1948. J. Howard and J. Bullough.
1913. T. Parker.	1922. J. M. Dunlop.
1953. A. Warner.	1929. T. L. Atkinson.
1901. J. Tatham.	1935. G. Bedson.

PATENTS NO WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1486. E. Lord.	1504. J. G. Jennings and J. Lovegrove.
1502. J. G. Jennings.	1481. H. W. Wimshurst.

THE

Journal of the Society of Arts,

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THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, JULY 14, 1865. [No. 660. VOL. XIII.

TABLE OF CONTENTS.

Proceedings of the Society.

MUSICAL EDUCATION COMMITTEE.

The following is a continuation of the information relating to Musical Education on the Continent, collected by this Committee:—

NATIONAL CONSERVATOIRE OF MUSIC AND ELOCUTION, FRANCE.

The following are the complete regulations now in force:—

In the name of the French people.

The Minister of the Interior,—Having regard to the decision of the 14th March, 1848, appointing a special commission for the purpose of seeking modifications to be introduced into the management and the teaching of the Conservatoire; having regard to the report made by this commission;* having regard to the report made by the Government commissioner on the *théatres lyriques* and the Conservatoire; on the advice of the commission of theatres, decrees as follows:—

DIVISION I.

CHAPTER I.

ARTICLE I.—The national conservatoire of music and of elocution is devoted to the gratuitous teaching of vocal and instrumental music and to dramatic declamation.

ARTICLE II.—This teaching is divided into eight sections:—

1. Study of the Solfeggio oral harmony, the study of keyed instruments, the learning of parts, which form the elementary instruction.
2. Singing.
3. Lyric elocution.
4. The piano and harp.
5. Stringed instruments.
6. Wind instruments.
7. Harmony, the organ, and composition.
8. Dramatic elocution.

ARTICLE III.—An elementary and popular course of class singing of a higher degree than that taught in the communal schools is open at the Conservatoire for adult females.

ARTICLE IV.—A library composed of musical works, and of books relative to the musical and dramatic arts, forms part of the establishment.

* The members of this commission were:—Messrs. Auber, Halevy, Lecouppey, Ponseron, Levasseur, Benoist, Girard, Meifred, Marmontel, Bazin, Samson, Provost, Louis Perrot, Rety.

DIVISION II.

CHAPTER II.—DIRECTION AND ADMINISTRATION.

ARTICLE V.—The Conservatoire is placed under the authority of a director, who directs all the works, and presides over all committees, in which he has the casting vote.

ARTICLE VI.—The director is appointed by the Minister of the Interior. In case of illness or absence, the minister designates the person who is to fulfil his duties.

ARTICLE VII.—The administration is composed besides of:—

1. A secretary attached to the direction.
2. An accountant entrusted with the receipt of money.
3. A superintendent of classes.
4. A head librarian.
5. An overseer of the library.

ARTICLE VIII.—All these functionaries, as well as those employed in the establishment, are appointed by the Minister of the Interior. Their salaries and their advancement are regulated in the following manner:—The commencing salary of the secretary is £80 (2,000 fr.); that of the accountable agent is £60 (1,500 fr.); that of the head librarian is £100 (2,500 fr.); that of the superintendent of classes, and of the overseer of the library, £48 (1,200 fr.); with increase of £12 (300 fr.) every five years, till a maximum is attained of £160 (4,000 fr.) for the secretary; £120 (3,000 fr.) for the accountable agent; £96 (2,400 fr.) for the superintendent of classes and the overseer of the library. The salary of the head librarian may be raised to £120 (3,000 fr.) after five years of service. The salaries of the servants in the establishment are from £16 to £32 the maximum. They are increased by the Minister of the Interior at the request of the Director.

DIVISION III.

CHAPTER III.—THE INSTRUCTION.

SECTION I.—ELEMENTARY INSTRUCTION.

§ 1.—*Sol-feggio.*

ARTICLE IX.—There are two kinds of Solfeggio teaching, namely, collective and individual.

ARTICLE X.—There are two classes of collective Solfeggio teaching. The number of pupils is unlimited. One of the classes is conducted by a professor; the other by an assistant-professor.

ARTICLE XI.—There are twelve classes of individual Solfeggio teaching. None of these classes may consist of more than twelve pupils. They are conducted by two professors, four assistant professors, and six teachers.

ARTICLE XII.—The director may appoint the teachers for any supplementary classes of Solfeggio that may be considered necessary.

Article XIII.—The duration of the course of collective Solfeggio is one year; that of individual Solfeggio is two years, except in certain cases, of which the committee of teaching is to be judge.

§ 2.—*Oral Harmony.*

Article XIV.—There is a class of oral harmony conducted by a professor. The number of pupils is unlimited.

§ 3.—*Study of Keyed Instruments.*

Article XV.—There are five classes for the study of keyed instruments. Two for male pupils, conducted by an assistant professor and a teacher; three for female pupils, conducted by an assistant professor and two teachers.

Article XVI.—These classes, to which at the most only eight pupils and two listeners (*auditeurs*) are admitted, are destined exclusively for the pupils of singing, of harmony, and of composition.

§ 4.—*Study of Parts.*

Article XVII.—There is a class for the study of parts annexed to the classes for lyric declamation.

Section II.—Singing.

Article XVIII.—There are eight classes for singing, conducted by professors.

Article XIX.—If needed, there may also be formed classes which will be conducted by assistant professors.

Article XX.—Each class consists of eight pupils and two listeners.

Article XXI.—One class is specially designed for the execution of concerted pieces for the pupils of the singing classes. The pupils of the classes for composition are bound to take part in it. This class is held once a week by the singing professors in turn.

Section III.—Lyric Declamation.

Article XXII.—There are four classes for lyric declamation; two for serious opera; two for comic opera.

Article XXIII.—These classes are conducted by professors, who must be musicians.

Section IV.—Piano and Harp.

Article XXIV.—There are five classes for the piano, of which two, for male pupils, are conducted by professors, and three for female pupils are conducted by two professors and one assistant professor. Each class is limited to eight pupils and two listeners.

Section V.—Stringed Instruments.

Article XXV.—There are three classes for the violin, two classes for the violoncello, and one class for the double bass. Each of these classes is conducted by a professor, and is limited to eight pupils and two listeners.

Section VI.—Wind Instruments.

Article XXVI.—There is a class for each of the following instruments:—Flute, hautboy, clarionet, horn, chromatic horn, bassoon, trumpet, trombone. All these classes are conducted by professors, and are limited to eight pupils and two listeners each.

Article XXVII.—There is a class of instrumental part music. Its programmes are so composed that the pupils for the piano, and stringed and wind instruments may take part in it. This class is held once a week by one of the instrumental professors in turn.

Section VII.—Harmony, Organ, and Composition.

Article XXVIII.—There are six classes for harmony, namely:—Two for written harmony for the male pupils, held by the professors, having at the most twelve pupils and four listeners. For the male pupils, two for harmony, and for practical accompaniment, held by professors, having at the most eight pupils and four listeners. For the female pupils, two for harmony and for practical accompaniment, one of which is held by a professor and the other by an assistant professor, having the same number of pupils and of listeners. The whole course of harmony and of accompaniment lasts three years at most.

Article XXIX.—There is a class for the organ and improvisation conducted by a professor. This class is limited to twelve pupils and two listeners.

Article XXX.—There are four classes for composition, which are limited to twelve pupils and four listeners each, and are conducted by professors. This teaching is divided into a course of counterpoint and fugue and a course of ideal composition.

Article XXXI.—No pupil is permitted to attend at the same time the classes for harmony and those for composition. Every pupil who aspires to follow the classes for composition has to undergo a preliminary examination in harmony.

Section VIII.—Dramatic Elocution.

Article XXXII.—There are three classes for dramatic declamation, conducted by professors. Each professor gives two lessons a week. All the pupils in dramatic declamation are bound to attend at the lessons of each professor.

Article XXXIII.—There is a dancing and a fencing-master for those pupils who are destined for the theatre. Both of them are sub-masters.

DIVISION IV.

Chapter IV.—The Professors.

Article XXXIV.—The body of teachers is composed of professors, assistant professors, and teachers.

Article XXXV.—The professors are appointed by the Minister of the Interior from two lists of three candidates each, viz., for all the classes which are attached to the musical teaching, the one by the Committee of Musical Studies, the other by the director of the Conservatoire; and for the classes of dramatic declamation, the one by the Committee of Dramatic Studies, the other by the director. These two lists are to be addressed to the Minister of the Interior by the director of the Conservatoire.

Article XXXVI.—The assistant professors are appointed by the Minister of the Interior from a list of three candidates, which is presented by the Director.

Article XXXVII.—All the professors are paid. They are divided into four classes, of which the salaries are fixed as follows:—

Professors.

1st Class	£80	(2,000 frs.)
2nd Class	£72	(1,800 frs.)
3rd Class	£60	(1,500 frs.)
4th Class	£48	(1,200 frs.)

Assistant-Professors.

1st Class	£40	(1,000 frs.)
2nd Class	£36	(900 frs.)
3rd Class	£24	(600 frs.)
4th Class	£12	(300 frs.)

Article XXXVIII.—There are two exceptions to this scale of salaries in the case of the professors—1st. The professors of composition, who receive a fixed salary of £80 [2,000 frs.] 2nd. The professors of Solfeggio or elementary class, who receive salaries according to the following scale for the four classes:—

1st	£64	(1,600 frs.)
2nd	£56	(14,00 frs.)
3rd	£48	(1,200 frs.)
4th	£40	(1,000 frs.)

Article XXXIX.—The assistant professors in the elementary classes receive the same salary as in the higher classes.

Article XL.—Every professor, or assistant professor, on his entrance, takes rank in the fourth class, and receives his salary accordingly. Nevertheless, a professor in an elementary class who is appointed to another branch of the service, takes rank in that class the salary of which is immediately above that which he received as an elementary professor.

Article XLI.—After three years of service in one of

the four classes, each professor has the right to pass into the class above, and receive a salary accordingly. In the case of there being no spare funds, he has a right to the first money that shall become vacant after his promotion. In the case when two professors shall be promoted on the same day, the allowance of money shall be made to him who has served longest.

ARTICLE XLII.—The professors and assistant professors are bound to give three lessons of two hours each per week. Those who, without leave formally granted, or without being authorised by the director, shall fail to give three lessons in the month, shall be deprived of their salary for the said month.

ARTICLE XLIII.—The pensioning of the professors is directed by the Minister of the Interior, on the advice of the theatrical commission.

ARTICLE XLIV.—The professors may be dismissed on account of unpunctuality, or for any other grave reason, on the report of the director or the Government commissioner, and the advice of the theatrical commission.

ARTICLE XLV.—The teachers are appointed by the director, on the nomination of the professors to whom they are attached. They have to give preparatory instruction, under the direction of the professors, to the pupils admitted into the classes. Their duties are only temporary, and must not last longer than three years, during which they themselves may take part in the lessons of the school.

DIVISION V.

CHAPTER V.—COMMITTEE OF INSTRUCTION.

ARTICLE XLVI.—The instruction is regulated by the director, in accordance with the deliberations of the committees of musical and dramatic studies.

ARTICLES XLVII.—The committee of musical studies is composed of twelve members, of whom nine, including the director and the Government Commissioner, belong to the Conservatoire; the three other members are chosen by persons who are not members of the establishment.

ARTICLE XLVIII.—The committee of dramatic studies is composed of the director, the government commissioner, the professor of the classes of declamation, and of three members who have nothing to do with the establishment. The government commissioners for the Théâtre Français and the Odéon have likewise to be present at its sittings.

ARTICLE XLIX.—The members of the committee of musical studies and of that of dramatic studies are appointed by the minister of the interior, on the proposal of the director. They are appointed for three years at least.

ARTICLE L.—The professors of the Conservatoire, who are members of the committee of musical studies, must be taken from the different sections of the instruction.

CHAPTER VI.—THE CLASSES AND THEIR MANAGEMENT.

ARTICLE LI.—The scholastic year begins on the 1st October, and finishes immediately after the competitive examinations.

ARTICLE LII.—All the classes are conducted within the walls of the Conservatoire.

ARTICLE LIII.—The instruction of the male is separated from that of the female pupils, except in the classes of lyric and dramatic declamation.

ARTICLE LIV.—The mothers of female pupils are allowed to be present at the lessons.

ARTICLE LV.—The director fixes the days and the hours of the classes of each professor. He distributes into the different classes the pupils admitted by the committees. He can make a pupil change classes if he considers that this change will assist his progress.

CHAPTER VII.—THE PUPILS, THEIR ADMISSION, THEIR RIGHTS, AND THEIR DUTIES.

ARTICLE LVI.—Candidates for the classes of the Conservatoire must have their names put down in the secretary's books.

ARTICLE LVII.—No candidate will be admitted who is less than nine, or more than twenty-two years old. Beyond this limit admission is granted only in the case when the candidate is considered sufficiently advanced to finish his studies in two years, or when he is gifted with extraordinary talent.

ARTICLE LVIII.—The candidates are examined and admitted by the committees.

ARTICLE LIX.—There are two examinations for admission—one in the month of December, the other in the month of June, at the conclusion of the half-yearly examinations of the classes. There is a third examination in the month of March, but only for candidates for the singing classes.

ARTICLE LX.—After their first examination the pupils are admitted, but only provisionally. Their final admission is granted only after the half-yearly examination which follows that of their temporary admission.

ARTICLE LXI.—Every pupil admitted—even those temporarily—must send up to the secretary a certificate of his birth, and another certifying that he has been vaccinated.

ARTICLE LXII.—After his final admission, the pupil has the right to remain in the classes at least one year.

ARTICLE LXIII.—The professors have the right to be present at the examination of candidates, each in his department.

ARTICLE LXIV.—The director may admit, without the concurrence of the committee of musical studies, candidates for the classes of solfeggio, part-singing, and instrumental part music. He may likewise admit candidates, or those pupils who desire to follow the courses which follow, to the classes of composition, counterpoint, and fugue, harmony, keyed instruments, the study of parts, lyric declamation, and theatrical deportment.

ARTICLE LXV.—The name of every pupil that misses his classes twice in a month without a legitimate excuse will be erased from the register.

ARTICLE LXVI.—No pupil may, under pain of dismissal, contract an engagement with any theatre, play a part, sing or execute any piece in a theatre, or orchestra, or at a public concert, without the express permission of the director.

ARTICLE LXVII.—Foreign candidates may be received with our special authorization. They enjoy the same privileges and have to fulfil the same duties as the national pupils.

ARTICLE LXVIII.—A report on the entrance and leaving of the pupils is sent to the Minister of the Interior every three months.

CHAPTER VIII.

ARTICLE LXIX.—There is a boarding-house for ten male pupils who are specially destined for lyric studies.

ARTICLE LXX.—An equal number of exhibitions of £32 (800 frs.) each is granted to the female pupils.

ARTICLE LXXI.—Eight exhibitions of £32 [800 frs.] each are granted to pupils of both sexes who follow the classes for special declamation.

ARTICLE LXXII.—The pupils that are admitted to the boarding-house are boarded, clothed, and maintained at the expense of the state.

ARTICLE LXXIII.—The admission to the boarding-house and the distribution of the exhibitions take place only after a competition before the committee of instruction. The candidates for the boarding-house are admitted on trial for six months; their final admission can only take place after a new examination.

ARTICLE LXXIV.—Every pupil admitted to the boarding-house, or to whom an exhibition is granted, contracts in so doing to make his début at the expiration of his studies at one of the theatres (which receives a grant from the state). This obligation gives him the right also to make his début at one of these theatres.

ARTICLE LXXV.—The boarding-house is placed under the superintendence of a principal musician. A code of regulations of government and discipline will provide for measures relative to the boarding-house, the external

establishment, the details of the classes, and of the internal arrangements.

Article LXXVI.—If the government considers it right to make a candidate come from the departments, twopence halfpenny a mile (*quinze centimes par kilomètre*) is granted to him for the expenses of his journey to Paris, and two shillings (*deux francs cinquante centimes*) a day at Paris, to be reckoned from the day of arrival to that of departure, if he has not been admitted; in this latter case he receives the same indemnity of twopence half-penny a mile for his return.

Chapter IX.—The Half-yearly Examinations, Competitions, and Exercises.

Article LXXVII.—All the classes are examined by the committees of instruction in December and in June, in order to judge the results of the studies.

Article LXXVIII.—There is also a supplementary examination in March for the classes of singing and dramatic declamation.

Article LXXIX.—The half-yearly examination in June has likewise for its object the determination of those pupils who are to take part in the competitive examinations.

Article LXXX.—All the classes have competitive examinations. The competitions of the classes of Solfeggio, the study of keyed instruments, and oral harmony are not public. The competitions in composition, harmony, and accompaniment take place in private. The pupils of the class of lyric composition compete at the Institute for the grand prizes in musical composition.

Article LXXXI.—Every class, whatever be the title or rank of its professors, may bring to compete any pupils who may be judged worthy by the committee.

Article LXXXII.—The pupils of the same sex and of the same speciality, whatever be the number of the classes or that of the competitors, compete together. The pupils of both sexes are only examined together in the competitions in special and lyric elocution, and in oral harmony.

Article LXXXIII.—The pupils of the Solfeggio class are not allowed to compete when more than fifteen years old, except in cases of which the committee of instruction is to be judge.

Article LXXXIV.—The pupils who have studied less than six months, and those who, having made their *debut* in theatres, remain nevertheless in the classes in order to render themselves more perfect, are not allowed to compete.

Article LXXXV.—Every pupil who, after two years and a half of study, has not been admitted to the competitions, has his name erased from the register. Those pupils also are dismissed from the Conservatoire who, having competed three times, have obtained neither a prize nor an accessit; and also those who, having obtained a second prize, have competed unsuccessfully twice for the first prize.

Article LXXXVI.—The public competitions commence on the first Monday in August.

Article LXXXVII.—The subjects for competition are determined every year by the committees of instruction on the proposition of the director.

Article LXXXVIII.—There can only be granted one first prize, one second, and three progressive accessits in all the branches of instruction, for the pupils of each sex, in the classes in which they compete separately.

Article LXXXIX.—In the case in which the same prize shall be assigned to two or more pupils, the prize shall belong to him who shall have most votes in his favour, and in the case of an equal number of votes, to the eldest, to the exclusion of the others.

Article XC.—Nevertheless, in the case where the jury shall agree unanimously that the pupils have shown equal merit, a first prize may be granted to each of them.

Article XCI.—A first prize, a second, and progressive accessits are granted separately to the male and female pupils who compete in the classes for lyric and dramatic elocution.

Article XCII.—Two honourable mentions, authenticated by medals, are granted at the competition in the studies of keyed instruments.

Article XCIII.—The jury of each competition, presided over by the director, is composed of four members of the Conservatoire and four non-members appointed by the minister at the proposal of the director. The jury for special declamation is composed entirely of non-members of the Conservatoire.

Article XCIV.—The professors of the school, or other members of the jury, must decline adjudicating in those competitions in which the pupils to whom they have given instruction in the year take part. All prizes or accessits gained in contravention of this regulation are annulled.

Article XLV.—The jury first decides if each prize ought to be granted. The president announces the result of this decision, and the prizes are then granted to those that have the majority of votes, by means of voting papers on which each member writes his name. These voting papers are handed over to the president, who places them in the urn, then ascertains the result, and makes it known, proclaiming the number of votes obtained by each competitor, and then the names of the prizemen. The same course is followed with regard to the accessits.

Article XCVI.—The distribution of prizes takes place in November. Prizes are given to the prizemen, and medals to those who have gained accessits. With them is given a certificate, bearing the name of the pupil, the nature of the prize or accessit, and the date of the year in which it has been obtained.

Article XCVII.—A pupil who has gained a first prize may remain in his class one year longer, but he is over and above the fixed number.

Article XCVIII.—In November and in June six lyric and dramatic exercises, are held in the large room of the Conservatoire. The pupils who are named by the director to take part in them cannot be exempted without a legitimate excuse.

DIVISION VI.

Chapter X.—The Library.

Article XCIX.—The library of the Conservatoire is public. It is increasing by all new works being deposited there, in virtue of the ordinance of the 29th March, 1834, and by purchase, for which a special sum of money is granted.

Article C.—The chief librarian has to keep a double catalogue of all the works.

Article CI.—No work may be lent beyond the Conservatoire without the authorisation of the director.

Article CII.—There will be added to the library a collection of dramatic masterpieces of all kinds, and of didactic works on the theatrical art, and on the art of declamation.

GENERAL ORDER.

Article CIII.—The Director and the Government Commissioner for lyric theatres and the Conservatoire are entrusted with the carrying out of the present regulations, under the superintendence of the Theatrical Commission created by the decree of the 2nd January, 1850.

Signed, J. Baroche,
The Secretary-General Delmas.

Paris, 22nd November, 1850.

Proceedings of Institutions.

Carlisle Mechanics' Institute.—The last report says that while the year has been marked by no extraordinary event, the Institute has made sure and sound progress. 21 new works have been added in the library, 23 renewed, and 74 re-bound. There are at present over 4,050 volumes in the library. 9,410 volumes have been taken out by the members during the year. During the winter months

three classes have been in operation, which, on the whole, have been well attended. During the season seven lectures have been given—two on Astronomy, by Mr. Mackintosh; one on Earthquakes, by Mr. Lowe; three on America, by the president of the Institute; and one by Mr. Wheatley, on Water. There is a decrease of 16 members as compared with last year. The number is as follows:—Full members and annual subscribers, 327; reading members, 115; total, 442. The Carlisle penny readings have this year been under the auspices of the committee, and they were attended with very great success. The balance-sheet shows that the receipts were £241 12s. 9d., and there is a small balance in favour of the Institution.

LEICESTER CHURCH OF ENGLAND INSTITUTE.—The seventh annual report congratulates the members upon the increase in the number of junior subscribers during the past year. The total number of junior quarterly subscriptions for the year 1863 was 267; that for 1864 is 278. This total amount has, however, been more unequally distributed through the various quarters than in any previous year; the number of junior members in the first quarter being 78, in the second 47, in the third 38, in the fourth 115. In view of this, and in order to secure a larger number of members during the summer quarters, the committee recommend that the annual subscription for the junior members be lowered from ten shillings to eight shillings, payable in advance; the quarterly subscription continuing to be, as before, half-a-crown. The committee regret to say that the subscriptions of the senior members have fallen off during the past year, and that the balance due to the treasurer has slightly increased. The best thanks of the committee are due to the teachers of the classes for their invaluable assistance. The balance-sheet shows that the expenditure has been £90 5s. 6d., and that there is a balance due to the treasurer of £18 9s. 11d.

WAKEFIELD MECHANICS' INSTITUTION.—The twenty-fourth annual report shows that the number of members was 710. The library has received the addition of 365 volumes during the year, making a total of 6,156 volumes. The elementary evening classes exhibit a steady attendance on the part of the pupils. The number on the books in the adult class was 36, with an average attendance of 14. The number on the books in the boys' class is 50, and the average attendance 15. In the girls' class, although the highest number attending has been 23, yet greater progress has been made than during the preceding year. The drawing class has had an attendance equal to last year, and the progress of the pupils has been, on the whole, satisfactory. The chess club maintains its position as one of the best in the provinces in connection with a mechanics' institution. Twenty-one lectures were delivered during the winter months, the attendance at which showed a falling off from previous years. Amongst them may be mentioned:—Mrs. Clara Lucas Balfour—"Henry the Eighth;" Rev. Hugh Stowell Brown—"Common Sense;" John Rawson, Esq.—"The Life and Times of John Milton;" Wm. Proctor, Esq., M.D., F.C.S.—"On the Colouring Principles of Coal Tar;" E. A. Leatham, Esq., M.A., M.P.—"William, Lord Russell;" Henry Wood, Esq.—"A Glance at Westminster Hall;" G. Dawson, Esq., M.A.—"Dr. Samuel Johnson;" Edmund Wheeler, Esq., C.E., F.R.A.S.—"An inquiry respecting the rational and intellectual powers of animals, and their instinctive faculties as compared with man; P. O'Callaghan, Esq., B.A.—"The condition of the Primæval Inhabitants of the British Islands;" Rev. H. Griffiths—"The Age of Great Reptiles;" S. W. North, Esq., M.R.C.S.—"Antiquity of Man." The Saturday night savings' bank has continued to attract its usual amount of attention. The number of depositors has been 7,856, being an increase over last year. In the penny readings the attendance showed a great falling off from the previous year, the average for the whole time being only 99. The largest attendance was 260; the smallest, 35. The receipts were £9 1s. 6d.; the expenditure, £7 13s. 11d. The treasurer's account shows that the receipts have been £283 17s. 2d.

WELCHPOOL READING SOCIETY.—The report of the committee for 1864 says that the subscription list proves that the present position is better adapted for the purposes of the society. The committee have ventured during the past winter to introduce penny readings in furtherance of the general objects of the society, and they entertain a hope of being able from this source to make a considerable addition to the library by the purchase of new books. The financial statement shows that the expenses have been £81 4s. 9d., and that there is a balance due to the treasurer of £21 13s. 9d. This has arisen from the great expense incurred in furnishing the house which was taken in New-street.

EXAMINATION PAPERS 1865.

(*Continued from page* 550.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

ASTRONOMY.

THREE HOURS ALLOWED.

1. Define a day; a solar day; a mean astronomical day; a lunar day; and a sidereal day.
2. State the difference between the civil, or common method of reckoning time, and the astronomical method.
3. Give the rule for determining astronomical time from civil time.
4. What is the equation of time, and for what purpose is it used.
5. Does the equation of time ever vanish, and if so when?
6. Does the equation of time vary from year to year, and if so why?
7. State what methods you know to determine mean time by observation.
8. Define sidereal time at mean noon.
9. The sidereal time at mean noon at Greenwich on January 1st, 1866, will be 18h. 43m. 38·3s., what will be the mean solar time corresponding to January 1st, 21h. 44m. 7·9s. sidereal time?
10. Convert 6h. Greenwich mean time on January 1st, 1866, into sidereal time for the same meridian.
11. Give an expression for finding the length of the day at any place.
12. What is the latitude of those places where the sun does not set for 24 hours on the 21st of June; and also of those places where the sun does not set for 24 hours on the 21st of December.
13. When is the sun due east on a given day?
14. Define moon's semi-diameter, and state when it is used, and for what purposes.
15. Define moon's horizontal parallax, state when and how it is used, and for what purpose.
16. The right ascension of the sun on

	h.	m.	s.
January 1, 1866, at mean noon is	18	47	31
,, 2, ,, ,, is	18	51	55
,, 3, ,, ,, is	18	56	20

What is the right ascension of the sun at Greenwich on Jan. 1st, 18h. mean time?

17. What is the right ascension of the sun on January 1, 1866, at 6h. Venice mean time, the longitude of Venice being 12° 21′ 21″ east of Greenwich?
18. Explain Kepler's laws.
19. Mention what is known of variable periodic stars.
20. Mention what is known of the prismatic spectra of stars and of planetary nebulæ.
21. Mention what you know of astronomical instruments, particularly the transit, mural-circle, transit-circle, and equatorial, with their uses.
22. Explain the use of the method of differences in the interpolation of series.

		h. m. s.	
23. Given right ascen.		2 57 50·74	on 1st day at mean midnight
		2 56 53·87	on 2nd ,,
		2 55 58·06	on 3rd ,,

Required accurately, using second differences, the right ascension on the 2nd day at 11h. 39m. mean time.

24. Given, the sun's declination at mean noon on

	h. m. s.
Jan. 19, 1866	=23 26 14·8
,, 20, ,,	=23 26 56·8
,, 21, ,,	=23 27 14·0
,, 22, ,,	=23 27 6·4

Required, the exact declination on the 21st day at 4h. 33m. mean solar time.

PRINCIPLES OF MECHANICS.

THREE HOURS ALLOWED.

1. State, without proof, the fundamental propositions which belong to statics, dynamics, and hydrostatics respectively.

2. Find the conditions of equilibrium of any number of forces acting in any direction on a material particle. Ex.: Three ropes, attached by a ring to a heavy block, are each stretched, at right angles to each other, by a weight of 50 lbs. What weight should be attached to a single rope that it may produce an equal effect upon the block, and how must it be placed with regard to the other three ropes?

3. Describe the common steelyard, and show how to graduate it. Ex.: A steelyard, having a weight of 10 lbs. at one end, and a scale-pan weighing 6 lbs. at the other end, is used as a balance by moving the rod backwards and forwards over a fulcrum, on which the whole rests; neglecting the weight of the steelyard, show how to graduate it.

4. Define the moment of a force about a point; show how it may be geometrically represented, and hence show that the sum of the moments of two non-parallel forces about a point in their plane equals the moment of their resultant about the same point. Show that the above statement is true if the forces be parallel. Ex.: Two parallel forces, 8 and 9, act at a distance of 17 inches from each other; what is the moment of their resultant about a point 12 inches distant from that force which is nearest to it, an inch being taken as the unit of length?

5. How do we obtain a measurement of variable velocity at any particular instant? What is the law of the velocity of freely falling bodies? Ex.: A body is projected downwards with a velocity of 80 feet per second; determine the velocity at the end of five seconds; if instead it were projected upwards, when would its velocity cease?

6. A body is acted upon continually by a given pressure; show what acceleration is given to its motion. Ex.: A body weighing 30 lbs. slides along a smooth horizontal plane under a constant pressure of 15 lbs.; determine (1) the velocity it acquires every second; (2) the velocity at the end of 5 seconds; (3) the space passed over in 5 seconds. What would be these results if the plane were rough, and the co-efficient of friction were ·2?

7. A body slides down a smooth curve; state and prove what velocity it will acquire at the end of the curve. Ex.: A stone is tied to the end of a string of 10 feet in length, and describes a vertical circle of which the string is the radius; if at the highest point it move at the rate of 25 feet per second, what will be its velocity at the lowest point?

8. What is a cycloid? Show that the time of oscillation of a particle moving in a cycloid is independent of the extent of the arc of oscillation. Ex.: If the radius of the generating circle be 10 feet, what is the time of an oscillation?

9. What is the fundamental principle, known as D'Alembert's principle, employed in rigid dynamics? Ex.: A sphere has a spherical eccentric cavity filled with water, and rolls on a rough horizontal plane; find its motion.

10. What are the differences between elastic and non-elastic fluids? Give examples of each.

11. Prove that the pressure at any point below the surface of a uniform fluid which is at rest under gravity alone varies with the depth. What is the pressure tending to drive in the cork of an empty bottle sunk to the depth of 300 fathoms in seawater (S.G. = 1·028), when the barometer is 30 inches (S.G. of mercury = 13·6), the area of the cork being a square inch? N.B.—A cubic foot of distilled water weighs 1,000 oz.

12. Describe a common hydrostatic balance and show how by means of it to find the S.G. of a solid body—(1) heavier, (2) lighter than distilled water, the latter being used as the unit of measurement. Ex.: A crystal of saltpetre weighs 19 grains; when covered with wax (S.G. = ·96) the whole weighs 43 grains in air and 8 grains in water; find the S.G. of the saltpetre.

13. Describe a condenser, and find the corresponding densities of the air before and after a given number of strokes.

14. Describe the essential parts of a double-acting condensing steam-engine. State what you know of the latest mechanical improvements applied to this kind of engine.

PRACTICAL MECHANICS.

THREE HOURS ALLOWED.

1. In toothed-wheel work what is meant by the *pitch circle* and the *pitch of a tooth*; what is the diameter of the pitch circle of a wheel having 88 teeth of $2\frac{1}{2}$ inch pitch?

2. Explain the contrivance of the *crank and connecting rod*, for converting circular into reciprocating motion, and show that the movement which would result from a crank with an infinite connecting rod may be imitated by the use of an *eccentric circle*.

3. Explain the following mechanical contrivances; (1) the anchor escapement, (2) the mangle wheel, (3) the Geneva stop, (4) the fusee.

4. A wheel (A) is fixed in space; an arm carrying two other wheels (B) and (C), is capable of revolving about an axis through the centre of (A), and it is further arranged that the three wheels shall gear together, so as to form a train (A), (B), (C); what will be the motion imparted to (C) by the revolution of the arm, (1) when (C) is equal to (A), and (2) when it contains half as many teeth as (A); explain your answer, and point out the value of the first combination in machinery for twisting strands into rope.

5. Explain the *parallel motion* of a beam-engine.

6. Upon what principle is machinery for drilling made self-acting? Select an example which illustrates your statement.

7. Describe some arrangement which would serve to indicate the number of revolutions made by a carriage wheel in a given time.

8. Explain Newcomen's atmospheric engine, and show how it was altered and improved by Watt.

9. Why is it advantageous to work a steam-engine expansively; if steam of a given pressure be cut off when the piston has described one-fourth of its stroke, find the work done in the cylinder. What is the lap of a slide-valve, and what effect does it produce in the working of the engine?

10. Sketch a double-beat valve, and explain its action.

11. Explain any form of gauge for measuring the pressure of steam in a boiler.

12. Describe the general arrangement of a locomotive engine and boiler, and explain Stephenson's *link motion* for reversing the engine.

(*To be continued.*)

THE MUSICAL UNION INSTITUTE.

The following is extracted from Mr. Ella's *Musical Record*:—

The objects sought to be accomplished by the formation of an Institute have never ceased to occupy my attention since the idea was first mooted in the *Record* of 1849. The interest which the lamented Prince Consort took in the promotion of the arts in general, his knowledge of and taste for music in particular, were most encouraging; and his express desire to the late noble President, the Earl of Westmorland, to carry out a design similar to the one I have attempted, was communicated, confidentially, to me in 1853. In a letter addressed to me in that year by a liberal patron of the art, a thousand pounds was promised in aid of the scheme, provided my small beginnings were joined to that of the Prince Consort for a public library. During the short time that elapsed from the opening of the Musical Union Institute until the lamented death of that excellent Prince, the donations exceeded in amount my most sanguine expectations. The death, however, of the Prince at once threw a damp on the public mind, and further contributions in hope of realising all that was aimed at fell short of what I had reason to anticipate.

This disappointment was the more to be deplored, since, in order to provide for the expected donations and purchase of musical publications, a large portion of the funds was already expended in furniture for the residence of a paid custodian, with ample accommodation for an extensive library.

It is now proposed by the treasurer and trustees to relieve me of the custody of books purchased and presented to the Institute. At the same time, with the funds at my disposal, I shall continue to increase the collection of music and musical literature, and add it to the property to be conveyed to the South Kensington Educational department of the Fine Arts.

To those spontaneous donors who encouraged my efforts to carry out a long cherished object, I cannot sufficiently express my gratitude. In acknowledgment of the support received from donors to the Musical Union Institute, I propose, with the sanction of the Committee, to issue singly free admissions to the Matinées of the Musical Union, viz., to donors of £20, four; £10, two; and £5, one, each season. J. Ella.

(Copy.)

London, 18, Hanover-square, May 18, 1865.

To the Secretary of the Department of Science and Art.

Sir,—Having long witnessed, with gratification, the facilities afforded at the South Kensington Museum for education in the Arts of Design, etc., and various branches of scientific pursuits, with the formation of libraries for study and reference, I have ventured to hope that music, the most popular and neglected of the arts in England, might also be specially encouraged at the South Kensington Museum.

An arrangement might, perhaps, be made to accommodate an extensive library of music, full scores of the great masterworks, and musical literature, with a collection illustrating the history and progress of musical instruments, for the use of the public in general and students in particular. Considering the great difficulties, cost, and risk, which attend the trials of new compositions of the highest class of art, I would suggest that it might be expedient that the Government should afford facilities analogous to those which have been given to the Royal Academy of Arts for the exhibition of painting, etc., for such trials, and also that lectures might be given on every branch of the art, the whole eventually becoming a recognised institute for musical education in this country.

That such an Institute was contemplated by the lamented Prince Consort, I have reason to know, and, with the view of aiding its accomplishmeet, I proposed, in the name of the trustees, W. Tite, Esq., M.P., and T. Brassey, Esq.,* and donors of the Musical Union Institute, under my direction, to submit to them the propriety of offering the gift of its collection of music and musical literature.

On certain specified conditions, at my decease or before, I propose that my private collection of music, musical literature, pictures, prints, autograpbs, and musical instruments, be added thereunto, and the sum of one thousand pounds, or more, be given in aid thereof. Other gifts, I feel sure, will follow, and ultimately London will be spared the reflection of being the only city in Europe without a National Institute and Library exclusively devoted to the interests of the musical art.

I request you to submit this proposal to the Lord President of the Council for his consideration.

I remain, Sir, your obedient servant,
(Signed) John Ella.
Hon. Mem. Phil. Acad. Rome,
Founder and Director of the Musical Union.

(Copy)

42, Lowndes-square, June 27th, 1865.

My Lord,—The "Musical Union Institute" was established in 1850 by Mr. Ella. Mr. Brassey and myself were appointed trustees; Sir George Clerk was the president; and a most respectable body of subscribers and donors soon joined the Association. We have subsequently done our best to carry out the intentions of the founder, and to support his views. Those views were to collect a library of music and musical literature, to form a museum of musical instruments, and to afford accommodation for the trials of music and encouragement to young and meritorious artists. All this we have endeavoured to carry out and support, and to a certain extent we have succeeded.

It has, however, occurred to Mr. Ella that this Institution might find a more permanent home at South Kensington, and I am authorised by a public meeting of the donors to offer to your lordship and the Council the collection of books belonging to the Institute.

In making this offer, we are requested to attach this condition: That the Council will carry out, as far as is consistent with the means at their disposal, the original objects of the Institution. I am to submit this proposition to your lordship, and to offer any explanation in my power of the views of Mr. Ella in proposing the removal of the Institute to South Kensington.

In furtherance of the above objects, I am authorised to say that as soon as accommodation is made for its reception, the harpsichord (A.D. 1651) of the great Handel, now the property of Messrs. Broadwoods, will be presented to the library.

I enclose an account of the inauguration ceremony, at which Mr. Brassey, myself, and the Council were present, which fully states all the objects sought to be obtained by the Institution, and a supplementary paper published under its sanction.

I have the honour to be, &c.,
(Signed) W. Tite.
Treasurer and Trustee.

The Rt. Hon. Lord Granville, &c.

The following answer to Mr. Tite's letter is couched in similar terms to one in reply to Mr. Ella's, in May last:—

Council of Education, Kensington Museum, 29th June, 1865.

Sir,—I am directed by the lord president to acknowledge the receipt of your letter, dated the 27th, and addressed to him, in which you are so kind as to offer, on behalf of the Musical Union Institute, a collection of books, and the harpsicord of Handel, on the condition that the department will carry out, as far as it is consistent with the means at its disposal, the original objects

* Donors of £100 each.

of the Musical Union Institute; and in reply I beg to inform you that the lords of the Committee of Council on Education have much pleasure in accepting the gift for the South Kensington Museum, on the conditions that you have named. Thanking you for your own personal interest in the subject,

I have the honour to be, Sir,
Your obedient servant,
HENRY COLE.

Fine Arts.

ART CONVENTIONS.—Three other acts, which aid towards the completion of international right in works of taste and intellect, have just been officially announced in Paris, namely, the signature of conventions respecting literary and artistic property between France and Saxony, Baden, and Nassau.

DISCOVERY OF A LOST RAPHAEL.—A picture by Raphael, known as the *Madonna di Loreto*, had been lost for a long time, and is said to have been recently discovered in the shop of a dealer at Mantua, by M. Tortella, of Verona. It was covered with such a thick coat of dirt that the lines of the composition could scarcely be traced, but was easily cleaned. The picture has since been examined by Professor Blaas and other acknowledged judges, all of whom pronounced it not only to be a true Raphael, but in his best style. It is in admirable preservation, and measures four feet in height and three in width.

PRIZE COMPETITION IN BRONZES IN PARIS.—The manufacturers of bronzes have announced a competition amongst the artists and workmen employed in that important and elegant branch of Paris industry. The prizes to be distributed are to consist of medals and honourable mentions, and the following amounts in money:—For sculptors and ornamental modellers, each 800f.; chasers, 1,600f.; designers, 500f.; founders, 600f.; turners, 400f.; mounters, 300f. The works are to be sent in by the 16th of November. It is not stated whether there will be a public exhibition of the works, but it is to be hoped that there will, not only in justice to the artists and workmen themselves, but also as an excellent means of general art education.

MUSEUM OF MEDALS.—The Duc de Luynes some time since presented his magnificent collection of medals to the Bibliothèque Impériale of Paris, on condition that it should be maintained and exhibited to the public in a completely independent condition. In pursuance of the terms of the donation the medals have been arranged in a rotunda, and several adjoining apartments in the new portion of the library building, and a special door and staircase are now being constructed by which the public will be admitted to the Luynes gallery.

Manufactures.

BUTTER-MAKING.—It is well known that cream may be converted into butter by simply being buried in the ground, but it is not generally known that this mode is in common use in Normandy and some other parts of France. The process is as follows:—The cream is placed in a linen bag, of moderate thickness, which is carefully secured and placed in a hole in the ground, about a foot and a half deep; it is then covered up and left for twenty-four or twenty-five hours. When taken out the cream is very hard, and only requires beating for a short time with a wooden mallet, after which half a glass of water is thrown upon it, which causes the butter-milk to separate from the butter. If the quantity of cream to be converted into butter is large, it is left more than twenty-five hours in the ground. In winter, when the ground is frozen, the operation is performed in a cellar, the bag being well covered up with sand. Some persons place the bag containing the cream within a second bag, in order to prevent the chance of any taint from the earth. This system saves labour, and is stated to produce a larger amount of butter than churning, and of excellent quality, and is, moreover, said never to fail.

STEAM FIRE-ENGINES AT THE COLOGNE INTERNATIONAL EXHIBITION.—The following is a copy of the official report concerning the decision of the jury at the trial of steam fire-engines held at Cologne:—The adjudicators, when judging of the steam fire-engines, paid attention chiefly to the following points:—1. The time required for getting sufficient steam to work the engines. 2. The quantity of water in general, and especially its density in proportion to the distance over which the water was thrown. 3. The height of the stream. 4. The general construction of the engines, and especially their durability and steadiness while being worked. 5. The weight, from which to draw conclusions as to their transportability. As regards the getting of steam for working the engines, the engine of Messrs. Merryweather and Sons, of London, effected this in 7 minutes 28 seconds; that of Messrs. Shand, Mason, and Co., of London, in 11 minutes 28 seconds; and that of Messrs. Wirth and Co., of Frankfort-on-the-Maine, in 16½ minutes. At a distance of 40 feet the largest quantity of water was thrown by the engine of Messrs. Shand, Mason, and Co.; the second in this respect were Messrs. Wirth and Co.; whilst as regards the compactness of the stream the latter decidedly took the first place, and Messrs. Shand, Mason, and Co., were second in this respect. At a distance of 60 feet, Messrs. Wirth and Co. took the first place, and Messrs. Merryweather and Sons the second place. As, however, the dimensions and working power of the engines are taken into consideration, then Messrs. Merryweather and Sons are fairly entitled to the first place; there is also to mention that the engine of Messrs. Wirth and Co. was worked during a wind that was more favourable than that under which the other two had to stand the trial. Concerning the heights of the streams, the engine of Messrs. Wirth and Co. was first, even if full consideration is given to the unfavourable wind which the other two engines had to work against. All practical questions, as regards the construction of steam fire-engines, have not yet been decided. All three engines are of solid workmanship, and fully warrant, during the usual duration of working time, as regards steadiness, every advantage that could be wished for. The weights of the engines are as follows, viz.:—Messrs. Merryweather and Sons, 3,813 lbs.; Messrs. Shand, Mason, and Co., 6,128 lbs.; Messrs. Wirth and Co., 5,833 lbs. Considering the short space of time in which Messrs. Merryweather and Sons' engine commenced working after the time of lighting the fire, and considering the proportionately equal results in other respects, and, further, in consideration of the strikingly light weight of the engine, the adjudicators declare that they have awarded to the steam fire-engine of Messrs. Merryweather and Sons, of London, the money prize of 500 thalers, and a gold medal to the steam fire-engine of Messrs. Shand, Mason, and Co., of London; also a silver medal, granted by the ministry, to the steam fire-engine of Messrs. Wirth and Co., of Frankfort-on-the-Maine.

Colonies.

NATAL EXHIBITION.—A Natal journal of April last says:—"It has been announced that arrangements are in progress for holding an exhibition in this city (Pietermaritzburg) at an early period. The object of the exhibition is to encourage industrious and productive habits amongst the natives, and it is hoped that it may also serve as a valuable suggestion in directing the course of native labour."

THE CLIMATE OF AUSTRALIA.—The great characteristic of the climate of Australia appears to be its dryness and purity of solar light, and freedom from humidity and the

consequent smaller proportion of deleterious gases and malaria in combination with an almost total absence of animal and vegetable decomposition; the astringent and chemical properties of the atmosphere may be observed by its action on gun and other metals, which may be exposed out of doors, day and night for months (except in rainy weather), without contracting any oxydation; also in the facility with which all animal and organic substances are dissolved and volatilised, and the bones bleached to a snowy whiteness in a comparatively short period. In the summer the carcase of a horse or bullock becomes a beautifully bleached skeleton in 10 to 14 days, the knife only having been employed to take off the hide. In no other country is the climate so congenial to man's physical energies as that of the Australian colonies—both man and beast can undergo all the fatigue of daily labour with less exhaustion and greater endurance than in any other country.

Shale Oil in New South Wales.—A discovery of considerable importance is said to have been made in the Illawara district. It had long been known that a highly inflammable substance abounded in that locality, but it is only recently that the fact of its containing a large secretion of kerosene oil has been discovered. It appears that a short time ago two gentlemen, practically acquainted with the manufacture of oils, paid a visit to the district. They took specimens of the shale in which the oil was expected to be found back with them to Sydney, and submitted them to analysis, which showed them to be very rich in oil. Twenty-one pounds of shale, put into a common iron pot, with a worm attached, in a short time yielded a quantity of oil, which was of very good marketable quality. The quantity yielded by the twenty-one pounds of shale was one gallon, and this, too, with a most imperfect apparatus. It is believed that, with proper apparatus, the shale will yield fifty per cent. of oil. The oil can be produced and packed in tuns at one shilling and sixpence per gallon, whilst the price in England during the past few years has ruled from three shillings and nine-pence to six shillings per gallon.

Woods of New South Wales.—There are in the Museum at Sydney hundreds of specimens of wood, the principal of which are rosewood, beefwood, cypress or pine, forest oak, and tulip wood. 308 specimens of these, as well as hardwood, were sent to the International Exhibition of 1862, and a variety of cabinets were made with duplicates of them, by Messrs. Howard and Son, of Oxford-street. Rosewood is probably the most beautiful of those which have yet been worked either here or in the colony. Although called rosewood there, it is entirely different in colour from the purple red rosewood of Brazil, the Canary Islands, &c. Its colour is nearly the same as the mahogany of Honduras and Campeachy, and undoubtedly equal in beauty of grain as well as durability to the products of these places. The fine trees which furnish these woods grow to an immense size. The timber is found to be very durable in wet soils, and therefore is in great demand for posts and rails. It is easily worked. Beefwood in colour and grain is truly beautiful, and would be most useful for veneers. Cypress and forest oak are very fine but different species of acacia. Tulip wood is also a very fine wood, but apt to split in cutting.

Publications Issued.

Statistics of the British Colonies.—The statistical department of the Board of Trade has just presented to Parliament an "Abstract of Colonial Statistics" on the model of the "Statistical Abstract of the United Kingdom." This small volume gives, in the most portable and accessible form, the general statistics of each British colony, from the year 1850 to 1863. The volume can be bought at the office for the sale of parliamentary papers, price 4d.

Notes.

Paris Great Exhibition of 1867.—It is said that the Champ de Mars has been definitely decided on for the locality of the next great International Exhibition, and that the preparatory works will be commenced on the sixteenth of August, the day after that of the Imperial fête. The building to be erected there will, however, only contain the industrial portion of the Exhibition; the fine arts will be represented in the Palais de l'Industrie, in the Champs Elysées, on the opposite bank of the Seine, where the annual *salons* or exhibitions of the works of living artists are now held.

The French Grand Prize in Science.—In 1859, Napoleon III. instituted by decree a grand triennial prize of twenty thousand francs, to be awarded in turn by the five academies of the French *Institut*, for the work or discovery reflecting the greatest honour or doing the greatest service to the country, published or made during the ten years preceding the award. In 1861 this prize of honour was given by the Académie Francaise, to M. Thiers, for his "History of the Consulate and the Empire;" in 1863 it was awarded by the Académie des Inscriptions et Belles Lettres, to M. J. Oppert, for his labours in connection with the cuneiform inscriptions of the valley of the Euphrates; this year the prize has been given by the Académie des Sciences, to M. Wurtz, Professor in the Faculty of Medicine in the University of Paris, for his labours and discoveries in organic chemistry. M. Wurtz's name is especially connected with the discovery of the ammoniacal compounds and glucose, and his chief work is entitled "Leçons de Philosophie Chimique."

Mechanical Music.—A question of some importance to musical composers and publishers was discussed a few days since by the French Legislature. Certain French and Swiss manufacturers have recently introduced a system by which various tunes may be played on mechanical organs and other instruments, with the aid of metal plates or wood blocks; and one ingenious maker, at Marseilles, has succeeded, it is said, in using cardboard and even paper forms, which he can multiply and sell at very moderate prices. A bill was introduced to legalise such applications, but it was warmly opposed, on the ground that it would be sanctioning an infringement of the rights of musical composers and proprietors of musical compositions. It was argued by the supporters of the bill that the method in question did not fall under the law of copyright, and that such productions were not equivalent to publication, or editions, of the works in question. A letter was read from Rossini, in which the *maestro* declared that he loved to hear his music played in the streets; but, on the other hand, a memorial was presented against the proposed measure, to which were attached the signatures of Auber, Berlioz, Thomas, and many other composers. The Corps Législatif passed the bill by a majority of 188 against 34, but the Senate, on a report brought up by M. Mérimée, rejected it.

Gas in Paris.—The first attempt in lighting the streets of Paris with gas was made on the last night in the year 1829, but it was not until after the revolution of July, in the following year, that it was generally adopted in the principal quarters of the city. In 1855 the consumption was under forty-one million cubic mètres; in 1860 it had reached seventy-five and a half millions; and in 1863 nearly a hundred and one millions. The pipes made a total of more than a thousand kilomètres, or about sixty miles, in the last named year. There are ten gas works in Paris, eight of which belong to the amalgamated Compagnie Parisienne, one to the Invalides, and the other to the Portable Gas Company. These ten establishments employ about two thousand seven hundred workmen, and

forty-three steam engines of a total nominal power of about five hundred horses. The General Gas Company employs also about five hundred men during two or three hours a day to light and extinguish the lamps. Great improvements are being made in the lighting of the city. From the corner of the Rue Royale to the Rond Point a new lamp is being interpolated between each of the original pairs, to the great enlightenment of the Champs Elysées.

Ventilation of Sewers.—M. Robinet, a French chemist, has put forth the following plan of clearing the sewers of Paris, in which a large number of accidents have occurred. He proposes to supply the great factories with air for their furnaces by means of tubes communicating with the interior of the sewers. By this means the latter will be cleared of mephitic gases, which will be destroyed by combustion in the furnaces. The quantity of coal consumed during the year in Paris is above 700,000 tons, and supposing that only one-tenth of this combustion can be utilized, M. Robinet calculates that four millions of cubic metres of fresh air, which is more than seven times the contents of the sewers, might be made to enter them daily. M. Robinet proposes to apply the same principle to hospitals, casernes, cesspools, and other places where impure air accumulates. This scheme corresponds with a system of ventilation expounded some time since by General Morin, and practised by him to a certain extent in the Conservatoire des Arts-et-Metiers, of which he is the director-in-chief.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Num.

Delivered on 28th June, 1865.

245. Bills—Admiralty Powers, &c. (as amended in Committee).
246. ,, Locomotives on Roads (Lords Amendments).
247. ,, Small Benefices (Ireland) Act (1860) Amendment (Lords Amendments).
248. ,, Procurators (Scotland) (Lords Amendments).
387. Lunacy—Nineteenth Report of Commissioners.
388. Army (Garden Ground)—Return.
394. Penal Servitude (Ireland)—Return.
395. Tipperary Police—Return.
396. William Parsons—Memorial.
415. Dublin Port—Return.
384. Coals, Cinders and Culm, &c.—Return.
377. Gunpowder—Return.

Delivered on 29th June, 1865.

249. Bills—Land Debentures (Ireland (Lords Amendments).
250. ,, Harbours Transfer (Lords Amendments).
218. Loan Societies—Abstract of Accounts.
390. Open Spaces (Metropolis)—Second Report.
397. Leeds Bankruptcy Court—Report and Evidence.
423. Navy (Master Class)—Memorandum.
424. Dr. Sutherland—Copies of the Appointment of.
Public General Acts—Caps. 38 to 50.

Delivered on 30th June, 1865.

52. (v.) Trade and Navigation Accounts (31st May, 1865).
407. Redundant List (Public Departments)—Return.
North America, No. 8 (1865)—Correspondence respecting Compensation to the Widow of the late Mr. Gray.

Delivered on 1st and 3rd July, 1865.

251. Bills—Foreign Jurisdiction Act Amendment.
252. ,, Rochdale Vicarage.
253. ,, Navy and Marines (Property of Deceased) (Lords Amendments).
254. ,, Naval Discipline Act Amendment.
381. Chemists and Druggists Bill, and Chemists and Druggists (No. 2) Bill—Special Report and Evidence.
408. Superior Courts of Law—Return.
417. Coinage—Account.
418. Bankruptcy—Returns.
427. Constabulary (Ireland)—Statement.
Education—Report of the Committee of Council (1864-65).
Hypothec (Scotland)—Report of Commissioners.

Patents.

From Commissioners of Patents Journal, July 7th.

Grants of Provisional Protection.

Bed, elastic mattress or spring—1652—W. E. Gedge.
Bottles, &c., wrappers for covering—1650—G. Clark.
Caloric engines—1563—S. B. Tucker.
Clothing, forming and making—758—G. Ralston.
Corn screens—1625—J. Hartley.
Cotton seed oil, purifying—1638—G. Payne.
Distilling and rectifying—1662—E. Vignier.
Fire-arms, breech-loading—1651—Abraham Colley.
Fire arms, casing to protect the stock and lock of—1403—A. G. Bigorie.
Fluids, apparatus for measuring—1667—M. Henry.
Gas burners—1658—J. Scholl.
Gunpowder—1636—A. Klein.
Hair, preservation of—1647—J. H. Johnson.
Horses, bit for subduing restive—1617—J. F. Dubois.
Horse hoes—1569—J. Holmes, G. T. Holmes, and F. R. Holmes.
Horse shoes—1629—R. A. Brooman.
Hydrometers—1349—H. A. Bonneville.
Lamp burners—1631—J. H. Johnson.
Leather, splitting and bevelling of—1635—H. E. Clifton.
Machines, silk winding—1633—W. T. Wanklyn.
Polishing, apparatus for—1668—C. H. Gardner.
Potash, production of chromate and bichromate of—1579—J. M. Dentith.
Pottery, apparatus for manufacturing—1627—W. E. Gedge.
Power, machinery for obtaining by fluid pressure—1576—J. Baker.
Railway carriages, ventilation of—1648—W. Clay.
Railway carriages, wheels for—1663—E. Dupont.
Railway trains, enabling guards to pass from one part to another of—1643—H. Defries.
Railway trains, communication between passengers and guard of—1659—W. Henson.
Railways, apparatus for preventing collisions on—1621—W. Clark.
Reaping and mowing machines—1660—M. Audinwood.
Roadway, floorings, &c., construction of—1639—T. R. Crampton.
Sewing machines—1661—D. McGlashan.
Steam engines, surface condensers for—1669—C. T. Porter.
Tools, apparatus for operating by hand or other power—600—J. Spence.
Vessels, improvements in propelling—1583—D. Spink.
Vessels, rigging of sailing-boats and—1670—W. C. Rickman.
Watches—1630—R. A. Brooman.
Wearing apparel, fastening—1615—S. Helcman.
Wearing apparel, stud for fastening—1616—S. Helcman.
Wheels, apparatus for moulding—1488—L. Martin.

Patents Sealed.

78. A. Meyer and M. Meyer.	134. J. Marshall.
85. W. E. Gedge.	137. J. Betteley.
86. W. E. Gedge.	140. R. A. Brooman.
88. R. A. Brooman.	141. F. H. Lakin.
99. E. T. Hughes.	144. C. T. Judkins.
102. R. A. Brooman.	146. F. P. H. Cahuzac.
104. G. Gaze.	199. T. Brown.
110. W. S. Longridge.	230. C. Falck.
112. A. J. Sax.	239. J. Southall and H. Southall.
114. J. Weeks.	263. F.A.Laurent & J.Casthelaz.
115. W. Ager.	314. W. Clark.
117. W. Wilkins.	413. G. Harton.
118. A. Paul and E. Paul.	790. R. J. Gatling.
125. T. Bourne.	982. J. G. Jones.
130. J. B. Farrar and J. Hirst.	992. T. Wilkes.

From Commissioners of Patents Journal, July 11th.

Patents Sealed.

160. M. B. Mason.	410. J. Gresham.
163. G. F. Bradbury.	447. W. E. Newton.
174. L. Balma.	655. W. T. Hamilton.
176. B. F. Stevens.	769. S. S. Gray.
216. O. Gossell.	771. J. T. Romminger.
231. W. Creasy.	775. A. G. Browning.
232. G. Dibley.	1052. H. Leonhardt.
241. John Combe.	

Patents on which the Stamp Duty of £50 has been Paid.

1973. A. Gilber.	2027. R. Ridley.
1975. J. Rhodes.	2028. A. Leslie.
2014. W. E. Cochrane.	2062. A. Cotelle.
2023. P. A. L. Canonicat.	

Patents no which the Stamp Duty of £100 has been paid.

1497. T. Restell.	1536. P. R. Hodge.
1528. J. D. Weston.	

Registered Designs.

Self-supplying double-action Syringe—June 24—4725—T. J. Croggan and W. B. Ritchie, Dowgate-hill, E.C.
A Croquet Stand—June 27—4726—T. Turner, Watford, Herts.
A Stay Fastener—June 30—4727—J. Ellis, jun., 39, Old Market-street, Bristol.
Rose for Door Knobs—July 3—4728—J. Whitemore and Son, Birmingham.
Elevating collapsing Music or Reading Stand—July 4—4729—C. Topham, 31, Bush-lane, City, E.C.
Framed Hat Brim—July 6—4730—H. and D. Baumann, 70, Fore-street, City.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, JULY 21, 1865. [No. 661. VOL. XIII.

TABLE OF CONTENTS.

Proceedings of the Society.

Musical Education Committee.

The following is the evidence of Mr. Lucas, Principal of the Royal Academy of Music:—

The Committee met on the 22nd May, at 3 o'clock, Mr. Henry Cole, C.B., in the chair. Present—Sir John Harington, Bart.; Sir G. Clerk, Bart.; Mr. Bowring, C.B.; Mr. Bowley; Lieut.-Col. Scott, R.E.; Capt. Donnelly, R.E.

Mr. C. Lucas gave evidence as follows:—

1. You are Principal of the Royal Academy of Music?—I am.

2. And, with the concurrence of the Directors of the Academy, are so kind as to attend here to give us information as to the working of the Academy?—Yes.

3. You hand in (referring to a document in his hand—See Appendix A., p. 572) a statement of the income and expenditure of the Royal Academy of Music for the year 1864?—Yes.

4. Does this include the parliamentary grant of £500?—It does.

5. Also a statement of the amount of tuition given to each student per week?—I may explain that more fully.

6. How long have you held the office of principal of the Academy?—I was appointed to the office in July, 1859.

7. Who was your immediate predecessor in that office?—Mr. Cipriani Potter.

8. Was he the first principal of the Academy?—No; Dr. Crotch. I was myself a pupil of Dr. Crotch at the Academy.

9. Your prospectus shows that the constitution of the Academy consists of a president, four vice-presidents, thirty directors, and a committee of management?—Yes; that is provided by the charter.

10. And it appears the Academy is incorporated by Royal Charter?—Yes.

11. The date of which is 1830, but the Academy was founded in 1822?—It was started in 1822, but was opened in 1823.

12. It also appears an attempt was made in the year 1720, to start a national school of music, but that its aim was simply the introduction and support of the Italian opera?—They called it the Academy of Music at that time. When what is now her Majesty's theatre was first started, it was called the Academy of Music, when Handel, Bononcini, and others, wrote operas there. It is merely from the similar name.

13. Would you put in evidence the prospectus of the Royal Academy and the regulations for its management?—Yes. (See Appendix B., p. 572.)

14. Where are your present premises?—Tenterden-street, Hanover-square.

15. Have they always been there?—Yes.

16. And always of the same extent?—When we had boarders they were more extensive. We used to have boarders.

17. You have no boarders now?—No.

18. Why not?—The expense was too great.

19. They are simply day students?—Yes; male and female.

20. Are the premises convenient?—No; very far from it.

21. Is there space sufficient?—No.

22. Do the students for the most part live in the immediate neighbourhood of the premises?—No; they live in various parts. That is one of the great difficulties we have in arranging the periods of their lessons so as to save them time. Supposing they live three or four miles off, it is very awkward.

23. What are the hours of the students' attendance?—Generally speaking, from ten till four; sometimes from nine till four.

24. Do they get refreshment on the premises?—No.

25. Must they go out for refreshment?—Yes; or bring it with them.

26. Have you convenience for refreshments?—No; no special convenience.

27. Do you find inconvenience from the want of such accommodation within the premises?—The lessons are arranged now so that no pupil need be there more than four hours per day. Supposing the pupil were in a singing class, he would be engaged in that for two hours, in the piano class one hour or two hours, and then he might go home and practice. Then another day they go to something else for a similar time. The classes are so arranged; for instance, if a person has a singing lesson for ten o'clock, he remains with the class afterwards for about two hours. The system is this:—Every pupil gets an individual lesson, but it is all done in classes. I put in a statement (Appendix C., p. 573) which is a correct account of the number of lessons each pupil receives per week.

28. For what length of time is the individual lesson?—Half-an-hour. It is in this way:—If the principal study be the pianoforte the pupil has an individual lesson for half-an-hour; but the class consists of four pupils, and each pupil would be present the whole time, hearing the remarks of the teacher. That is a general rule, particularly if all the pupils in the class are about equally advanced. It is practically having a lesson of two hours, but individually the master devotes half-an-hour

to each pupil. Then they go from that to singing, and receive a lesson for half-an-hour each in that class.

29. Do you mean that every pupil has half-an-hour's individual instruction ?—Yes ; twice a week, excepting in harmony, Italian, and elocution.

30. In those they are taught all together ?—For in-instruction in harmony, we have four pupils in the hour.

31. Do I understand you to say that, of the pupils learning singing, or instrumental performance of any kind, each one has half an hour's personal instruction ?—Yes ; twice a week.

32. Are the teachers numerous enough to admit of that, or the pupils too few ?—It is, perhaps, both.

33. How many pupils at the present time are learning singing.—Nineteen ladies and five males—twenty-four in all, as principal study. Others learn singing. The statement of the classes and professors' attendances for this term answers this in detail.

34. Receiving individual instruction in the way you mention ?—Yes ; I should wish to explain a little further about their studies. It is this : If a lady goes there and learns the pianoforte as the principal instrument, she has two half-hour's individual instruction, besides attending the class two hours. Then she has a singing lesson and lessons in harmony twice a week. Then, twice a week she is obliged to attend a sight-singing class and orchestral singing.

35. Whether she have a voice or not ?—Yes.

36. Do the pupils make choice of their instrument themselves ?—Yes : they make their selection.

37. For instance' if a pupil choses the violin for his instrument, he has to attend a sight-singing class ?—Yes ; and the orchestral and choral practices. The difference with ladies, who make singing their principal study, is, that they have but one lesson per week on the pianoforte, and one lesson per week in harmony ; but then they have Italian twice a-week, and elocution once a-week ; which makes the number of hours of individual instruction about the same ; and they have also to attend sight-singing, and orchestral and choral practices. It is the same with the male pupils ; if the violin be the principal study, they have two lessons per week on the pianoforte, and in harmony, and they attend the sight-singing practice—that is to make them able to read music well.

38. What do you do in the case of the pianoforte players ?—They rehearse solos and concertos, with accompaniments. The orchestral and choral practices are on Tuesdays and Fridays. The pupils are brought to those practices to make them acquainted with hearing an orchestra.

39. You make them singers for the nonce ?—If they do not play in the orchestra they sing in the choruses.

40. We quitted the subject of the premises rather abruptly. May I ask what is the present tenure of your premises ?—The lease has expired. We are now tenants from year to year.

41. Subject to the usual notice ?—The landlord, I believe, has no particular wish to disturb us. The fact may be stated that the premises were originally held under a long lease, which has now expired, and we are now only annual tenants.

42. Are you responsible for repairs ?—We were under the lease.

43. But you are so no longer ?—That depends perhaps on a matter of law.

44. It is no part of your present current expenditure to provide for the repairs of the premises ?—We have expenses for repairs.

45. Do you expend funds for repairs without the security of a lease ?—Not since the lease has expired.

46. Have you any projects in view for the alteration of the premises ?—That is hardly possible ; we want both funds and space to do so.

47. Then you have no intention of increasing the accommodation of the present premises ?—No ; most decidedly not.

48. But you wish for other and better accommodation than you have now ?—Decidedly.

49. Does your landlord hold out any hopes of improvement of the present premises ?—No ; not at all.

50. Are you situate in a neighbourhood you altogether approve of ?—No.

51. Perhaps the contrary ?—Yes ; very much so.

52. I gather that last year there were 59 pupils in the Academy ; and this year there are 71 ?—Yes.

53. Is the course of instruction at the Academy divided into sessions ?—We have three terms in the year, of about thirteen weeks each. It used formerly to be divided into four quarters ; but we found the attendance very small in the summer months, and, therefore, we have a long holiday, like most of the colleges.

54. We hear that in 1864 you had fifty-nine pupils, and that you have now seventy-one. What has been the average number of the last few years ?—They have varied from sixty to eighty. I think on an average we have about thirty come every year and thirty go away.

55. In the early history of the Academy, what was the average number of students ?—When the Academy was first opened I was myself among the first pupils, and at that time there were eighteen males and eighteen females.

56. After it got into full operation what was the number ?—I have known, I think, as many as 150 pupils at a time.

57.—Has there ever been more than 120 ?—Yes ; I think so.

58. I should like to know what is the maximum number ? —I will endeavour to give it you.

59. I understand you to say that there is orchestral and choral practice every week ?—Twice a week.

60. Of what pupils does that orchestral practice consist ?—At the present moment we are very deficient in wind instruments.

61.—It appears from this return which I hold in my hand, that there are only three pupils in the Academy now who are learning stringed instruments, and no pupil who is learning a wind instrument ?—There are only three making the violin their principal study, but several others learning that instrument, and some wind instruments as second studies. (See Appendix C.)

62. Are you able to make up a complete orchestra out of the present pupils of the Academy ?—Not complete ; we do as well as we can.

63. Can you tell me off-hand how many of the pupils are available for the orchestra ?—I should think we have 18 or 20 ; that is about what my orchestra consists of at the present moment.

64. There are only 5 male vocalists and 17 male pianists, therefore they must be taken principally out of the pianists ?—Yes.

65. When you speak of the orchestra, do you include voices and all ?—Yes.

66. What I want to arrive at is how many male pupils you can apply to instruments in your orchestra ; I do not mean singers ?—I should say at least 20. For instance, if the piano is the principal instrument of a pupil, he is obliged to learn an orchestral instrument as well. I have one who plays the flute, another the oboe, two others the violin, some the viola, others the violincello.

67. Do you consider that an advantage in their education ? You are obliged from want of funds, apparently, to make up an orchestra in the best way you can, and therefore you bring the pupils into the orchestra ; but if you had sufficient orchestral pupils, would you by preference bring in the pianoforte pupils also ?—Most certainly, for this reason ; however little they may know of the instrument, if they get into composition they will know how to write for the instruments. For that reason every pupil is allowed to take part in the orchestra.

68. Are you aware whether that is the practice abroad ? —Not I believe in many cases.

69. Then it arises out of your necessity ?—I think that is one of the advantages of the education in this country.

I maintain that students get a better musical education here than they do in the conservatoires of the Continent.

70. You think it an advantage to a pupil who wishes to devote his attention mainly to the pianoforte that he should play the flute?—Yes, I think so. If you look at the regulations of the Academy all that is explained.

71. The rent and taxes of your premises appear to amount to about £300 per annum.—Yes.

72. You say you have only a yearly tenancy of the premises. In the face of the enormous increase of rentals of houses would not that be a difficulty to the Academy in providing new premises, and might you not set aside a larger sum for the improvement of the present premises?—I think it might be difficult to get the accommodation we have now at the same rent; that is, to the same extent.

73. You tell us the accommodation is insufficient?—Yes; on account of the deficiency of funds we put up with many inconveniences. The premises have a less amount of accommodation than formerly, and we think we should have to pay increased rent for the same amount of accommodation elsewhere.

74. I hardly suppose these regulations are those by which the establishment is at present governed?—Yes, they are.

75. Then I apprehend there must be a mistake in your statement that those who wished to learn singing only are called upon to play an orchestral instrument?—Singing pupils have taken the double bass, for instance, but that is not insisted upon. Every singer is taught the pianoforte.

76. Then a pupil who wishes to learn singing must learn also the pianoforte, or some other instrument?—He must learn the pianoforte, but not necessarily any other instrument.

77. Are there any free scholars of the academy?—We have two scholarships which are entirely free, and two others which are partly so.

78. At Vienna the directors of the Academy have the power to give free education to pupils who have distinguished themselves at the commencement of their course, but it is a condition that they should be natives of Vienna. In other cases it is at their discretion to charge half-fees. May I ask if there is anything of that kind in the Royal Academy here?—I may state in the earlier days of the Academy a student, who has since become a distinguished professor, was boarded and educated for several years free; but that was at a time when the funds enabled the directors to do so.

79.—In some other cases has not a portion of the fees been remitted?—In some cases pupils have been admitted at reduced fees.

80.—I think it is desirable we should have from Mr. Lucas, if he will be kind enough to give it us, a statement of the particulars with regard to the system of giving so many lessons per week. I want to get a statement of the exact number of hours during which the pupils receive instruction in the week, and the tuition given to each pupil separately by the teacher?—You mean the number of pupils to each teacher.

81. Yes? and how often he attends.

81*a*. Do you think it would be advisable to pay the different professors by salary?—Yes, if we had funds to do so.

82. You have different rates of remuneration to your professors?—Yes.

83. Regulated by the *status* of the professor, and the time he gives to the Academy?—I may say all the professors are extremely liberal in their charges to the Academy. In the Conservatoire of Paris they pay their professors, not by the lesson, but by the year.

84. I want particularly to get Mr. Lucas's views on that subject. As it is now, the expense of each pupil is £45 a-year, or nearly that?—We have so arranged matters that the contributions of the pupils, as nearly as may be, disburse the remuneration to the professors; then there is their proportion of the rent and the general expenses.

85. It does more than that; because, by this paper, it appears that musical tuition alone costs only £27 a-year per pupil, whereas their subscription is £33?—Some of them cost more than they pay.

86. I understand you to say you do not pay your professors by annual salary?—No; by the hour.

87. You would prefer their being paid by salary?—Yes; I think so.

88. To pay by salary would be more expensive to the Academy?—Yes.

89. Have you considered the question of the desirability of paying the professors by salary with a proportion of the fees of the pupils, it being found in other public institutions a very convenient mode of payment?—No; I have not considered that question as yet.

90. As far as you know, is it true or not that professors of music habitually charge less for tuition at schools than they do for private tuition?—Some may, and no doubt do so. There are all sorts of prices paid.

91. And do they not charge now considerably less at the Academy than they do for private tuition? I believe some professors charge as low as half.—Yes; but, generally speaking, when they teach at schools, they have a sufficient number of pupils there to occupy them for half a day or more at a stretch; and then at schools they teach by the quarter or term; and they take the chance of all the pupils not always coming to receive their lessons.

92. Is it not to be presumed that professors would continue to teach at the Royal Academy at the same rate of remuneration as they are receiving now?—That is a question I can scarcely answer.

93. I presume there is some little distinction to be derived from being a teacher at the Royal Academy, and if it were established on a more important basis than at present, there would be all the more distinction in teaching there; therefore, I presume any reduction they now make would be made there?—I do not apprehend there would be much difficulty about that.

94. Are you able to state the essential difference between the Royal Academy of Music and the foreign Conservatoires?—First of all in the constitution and management. The management of the Royal Academy is explained in that prospectus, but most of the foreign Conservatoires are managed by the government.

95. Is that, in your opinion, an advantage?—In this respect, that the pupils are educated without charge.

96. Do you think it an advantage that the students should pay nothing for their education?—I think so. When this Academy was first opened, there were ten students elected on the foundation, and they were boarded and educated, and paid £10 a year. Then they admitted eight males and eight females, and these were called extra students. I was one of the first of that class, and I had to pay £30 a year.

97. You were boarded for that amount?—Yes; and educated.

98. Can you give any reason why music should be taught gratuitously when it is usual to pay for all else?—The principal reason is, as in the case we have been speaking about; generally you find great natural talent where there are no means to pay for the education. At Eton, Winchester, and other colleges, there are free students, why should not music be placed in the same scale?

99. But making the exception in favour of great talent—putting that aside for the moment which cannot pay for itself, and which it may be desirable to encourage, do you think, as a general principle, musical education should be gratuitous?—No.

100. You have mentioned the foreign Conservatoires. Is it not the case, in most of them, that the musical and operatic establishments are supported by the Government to a certain extent?—Yes.

101. In Leipsic there is no state subvention. The Academy is independent of the Government, and is supported by the subscriptions of the pupils and the dona-

tions of the public. It is the same in Vienna. It is the same, I believe, in Naples, Milan, and Brussels.

102. You have been asked about the foreign opera-houses being subsidized by the state; do you think they are better than our own?—In this country they are entirely the speculation of private individuals.

103. I mean the music itself; for instance, that the Italian opera of London is not as good as the Italian opera of Naples?—It is quite as good.

104. And as that of Paris?—Yes.

105. You think, notwithstanding our opera-houses are not subsidised by the state, we hold our own against those which are?—Yes.

106. As to the constitution and management, do you think there is any great difference between the management of the Royal Academy of Music and that of the foreign Conservatoires?—Yes; there is a great difference. The only Conservatoire I know much about is that of Paris. I was there at the time Cherubini was principal. He resided on the establishment.

107. You do not?—No; I have somewhat similar duties to perform. I have to go to the Academy to see that the masters and pupils attend, and all musical matters are referred to me, subject to the veto of the committee.

108. Does the committee meet often?—Once a week; but frequently in the autumn it is difficult to get the committee together; but when they meet, if I have made any memoranda, they are read over, and the committee either confirm or reject them.

109. Do the committee and the directors have joint meetings?—Sometimes; now and then. When there is business of great importance the whole of the directors are summoned to meet.

110. Latterly, I believe there have been some competitors to the Academy in teaching music?—Yes; the speculations of private individuals.

111. Do you think that may have interfered with the prosperity of the Academy?—Yes, to some extent. One is called the London Academy, where they profess to teach cheaper than the Academy; but the pupils do not get half so much instruction, and they are obliged to take private lessons, as they do in Leipsic. They pay £12 a year. I was speaking this morning to a person who was educated at Leipsic, and I found that the pupils there do not get the amount of lessons that we give them, and they are obliged to get private lessons as well. They have nominally orchestral practice once a week, but they have no teaching in wind instruments, nor even contra-bass.

112. You had a grant of £500 from Parliament last year?—Yes, for the first time.

113. I suppose the effect of that has not yet been much felt?—The effect of it has been that we are within our means now.

114. You appear to have a balance of £200?—Yes, on the last year's expenditure.

115. I see there is a balance in hand from the previous year?—No; it generally averaged that the amount was £500 short.

116. For how long was that?—For many years that was the case. When there were boarders, sometimes the yearly deficit was £1,200.

117. Was your application to Parliament for an annual subvention?—Yes.

118. Is there any reason to think it will be repeated?—It stands in the estimates for the present year.

119. Would you like the amount increased?—Oh, certainly.

120. Do you think you could show good cause why it should be increased?—Yes; it would enable us to assist pupils who have no means at their command.

121. Is not the present contribution of £33 a-year more than the friends of many of the pupils are able to pay with convenience?—Yes. There are some pupils from the country; and though they get an excellent musical education for the sum they pay, they are at the additional expense of their living in London. No pupil, under such circumstances, can remain at the Academy under an expense of £80 to £100 per annum.

122. If the House of Commons were willing to increase the grant so as to enable the Academy to establish free scholarships, should you think that a proper mode of assisting the Academy?—Yes; I should certainly.

123. And you see no objection to open competition for the scholarships?—None whatever.

124. Or any objection to the competition being spread widely over the whole country?—Not the least.

125. So that each locality might have an interest in sharing in a state subsidy of that character?—That is a large question, which I am scarcely prepared to answer at present.

126. Have you any mode of competitive examination at present?—Yes; for the scholarships.

127. Are they much sought after at the present time?—Oh, yes; for the scholarships vacant last Christmas, consisting of one male and one female, I think twenty ladies competed for the latter.

128. They have to provide for their living; but they get their education free?—Yes.

129. The competition takes place in London?—Yes.

130. What proportion of the pupils are candidates for these scholarships?—I should think about half-and-half. Generally speaking the pupils of the Academy know pretty well the tether or capabilities of their fellow students.

131. Are the pupils of the Academy ever beaten in the competitions by those outside it?—Yes; sometimes it is so.

132. Would it be fair to ask you what improvements you would suggest in the Royal Academy besides that of increased funds?—The reducing of the contributions of the pupils would be a great advantage.

133. Does not the present amount of the contribution required from the pupils in your opinion prevent their remaining at the Academy for so long a period as is required to complete their musical education?—Yes; certainly. That is one of our greatest difficulties; the pupils leave too soon.

134. Do you ever take a fee which covers a course of instruction for a long period?—No; only the fee for the term.

135. Should you feel that you exposed the Institution to any great risk by guaranteeing a course of instruction over two or three years, and taking a reduced fee to induce persons to enter for that period?—It is impossible to say. One pupil will do more in twelvemonths than another will in three years. I do not think a pupil ought to remain less than three years.

136. Would it not, in your opinion, be good policy to take a lower proportional fee for three years than the fee for each single term?—The fee barely covers the musical education now.

137. Supposing the House of Commons took a more liberal view than at present is the case in advancing musical education, would you see any objection to the increased subsidy taking the form of scholarship, open to the United Kingdom?—No; I should be very glad of it.

138. Government paying the fees?—Certainly. By degrees you may get everybody in.

139. You see no objection to the Government paying the fees for three years in advance?—None.

140. You would get a higher class of pupils in respect of talent, then?—Yes; probably so. We should turn out better pupils. I have alluded to the competitive examinations when the Academy first opened. Almost all the pupils who went in then turned out well because there was a choice, but since then we have been obliged to take in almost anybody.

141. You consider the pupils have not been of the same mark as formerly?—Perhaps not, on the average.

142. Because you have not been able to offer them such low terms?—We were not able to pick and choose.

143. Are you aware that the state does contribute towards musical education by requiring training schools to teach music?—Yes.

144. Have you ever had any pupils in the Academy from the training schools?—No; I do not think we have.

145. I will now call your attention to question No. 5, issued by the committee, which is as follows:—"Is any union between the Royal Academy and similar schools, cathedral choirs, or local institutions, desirable or otherwise?" In reference to that question it is necessary, perhaps, that I should read this letter, which has been addressed to the dean and chapters:—

"Royal Academy of Music, 4, Tenterden-street, Hanover-square, London.

"Very Reverend Sir,—I am directed by the Committee of the Royal Academy of Music to forward the enclosed particulars of the institution, and to request the favour of your kind attention to one of the objects proposed by its friends and promoters, the cultivation of ecclesiastical music; and, in order to further their views, I have the honour to inform you that a resolution has been passed offering to the deans and chapters of cathedrals in Great Britain and Ireland the musical education, on reduced terms, of any one of their choristers who, on leaving the choir from loss of voice, may be possessed of musical talent and may wish to follow the profession of music, and more especially that branch of it connected with our church service.

"The necessity for a complete musical education for such persons is manifest; and the Royal Academy of Music having now received the assistance of a grant of public money, the committee are desirous of opening the advantages of the institution to every class of musicians, among whom the student of church music has claims of the highest order.

"The usual fees for students are eleven guineas per term; but the committee have determined that a subscription of 20 guineas per annum shall entitle any dean and chapter to have one pupil in the Academy [who must have been a chorister in their cathedral], who shall remain there as a student for at least two years.

"I have the honour to be,
"Very Reverend Sir,
"Your obedient servant,
"J. GIMSON, Secretary."

146. Have you received any answers to that circular?—Yes.

147. Accepting the proposal?—They have not as yet availed themselves of it by sending any person up, but they have expressed their satisfaction at the nature of the offer made to them. There has not been time to receive many replies.

148. Has it ever occurred to the authorities of the Royal Academy that as the Ecclesiastical Commissioners have interested themselves in appropriating the revenues of cathedrals, they might with propriety be asked to carry out the intentions of our ancestors in promoting the study of ecclesiastical music, and do so through the instrumentality of the Royal Academy by applying some funds at their disposal for that purpose?—I am organist of Hanover Church, Regent-street, and soon after I was appointed I induced the committee of the Royal Academy of Music to require the pupils to sing in the choir there. My object in that was, we had gentlemen who came there to sing whose voices were such that they would turn out anything but Marios. I thought they would get a knowledge of and cultivate music, so as to be capable of taking a position in a cathedral choir. Then our treble sopranos were ladies. Strangely enough the gentlemen never took the same interest in that study, while my best lady-singers soon got engagements at the different churches. It is not a new thought as to the cultivation and study of ecclesiastical music.

149. My question went to this—The Royal Academy of Music is suffering from want of funds. The Royal Academy might promote the study of ecclesiastical music for the whole country by its central action. The Ecclesiastical Commissioners have busied themselves with ecclesiastical revenues for church purposes; might not, therefore, the Royal Academy of Music ask the Commissioners to give some pecuniary assistance in promoting instruction in ecclesiastical music in the different cathedral towns and churches of the country?—Mr. Bowley, a member of the committee observed—The Ecclesiastical Commissioners have obtained the funds of cathedral choirs, therefore the question will be strengthened. They took away a portion of the musical funds, and we may now ask them to give some back.

150. Do you consider the state of cathedral music capable of improvement?—Most certainly. It suffers from the same disease as the Royal Academy—want of funds. In most cathedrals there was sufficient money to support the choirs, but it has been used for other purposes. I was myself a chorister-boy, but received no musical education beyond learning the services and anthems.

151. I have in my hand the copy of another circular issued by the Royal Academy of Music, addressed to the various military bandmasters, or rather the colonels of regiments. May I ask you if you have any connection with Kneller Hall?—No; I believe there was some communication with the late Earl of Westmoreland, but his lordship did not approve of Government interference with the Royal Academy of Music.

152. You had not then arrived at obtaining the £500 grant?—No; not in his lordship's lifetime.

153. The Academy has issued the following circular?—Yes.

"Royal Academy of Music, 4, Tenterden-street,
"Hanover-square, 17th May, 1865.

"Sir,—The committee of the Royal Academy of Music have desired me to forward you a prospectus of the institution, stating its objects, &c., &c., and to call your attention particularly to the part respecting band-masters.

"Although, since the establishment of the Academy, the professors of this country have been enabled to hold their ground, and compete honourably and successfully with foreign artists generally, yet it is much to be regretted that, as far as regards military bands in England, they are very inferior to those of France, Germany, and Belgium.

"To remedy this by degrees, the committee have resolved to admit persons wishing to become band-masters on certain conditions, in order that by receiving a sound education they may become fully qualified to accept such appointments.

"It would enable them to arrange music suitably for their various bands and performers, and thus be the means of economising the funds appropriated for the band players.

"The committee have much pleasure in stating that three of the best bands in the service of Her Majesty, viz., the Grenadier, Coldstream, and Fusilier Guards, are presided over by gentlemen who received their education in the Royal Academy of Music.

"Subjoined is a copy of a letter in which you will see that His Royal Highness the Duke of Cambridge, Commander-in-Chief, highly approves of the resolution of the committee of the Academy.

"Any further information you might wish for will be readily given on application to Mr. C. Lucas, the Principal, or to me, the Secretary.

"I have the honour to be,
"Sir, your obedient servant,
"J. GIMSON, Secretary.

"Lt.-Colonel T. Addison."

[Copy]

"Horse Guards, March 21st, 1865.

"Sir,—I am desired by the Duke of Cambridge to acknowledge the receipt of your letter, and the enclosed resolution, which has given his Royal Highness great satisfaction. His Royal Highness considers that the directors of the Royal Academy of Music have conferred a great boon on the performers of wind instruments who

may intend to fill the position of masters in military bands, and which entirely meets with his Royal Highness's approval.

"I have the honour to be
"Your most obedient servant,
(Signed) "J. MACDONALD.

"Right Hon. Sir G. Clerk, Bart."

154. I understand you to say that the Academy has no connection with the training schools for singing throughout the country?—No, it has not.

155. Have you any library at the Academy?—Yes; but on a very small scale indeed.

156. How many volumes may you have?—We have several volumes of scores of operas and symphonies.

157. I believe there is no great number of works on musical science?—We have very few.

158. Has the Academy any relations with the various musical societies existing in London and elsewhere?—Only in this respect, that the orchestras of the Royal Italian Opera and at Exeter Hall are made up one-fourth perhaps of pupils of the Academy.

159. There are no official relations between you?—No.

160. Do you not think something might be done in the way of promoting the advance of your students by enabling them to be present at the performances of the various musical institutions of the metropolis?—We subscribe to the Philharmonic concerts, and have certain admissions to them.

161. Probably, if the funds permitted, you would subscribe to others with the same view?—Yes.

162. You think advantage would be derived from it?—Certainly.

163. Have you any collection or museum of musical instruments at the Academy?—None whatever, and I am not aware of the existence of any such museum in the county. The best of the kind I know of is that at Edinburgh.

164. That is under Professor Donaldson, I believe?—Yes; we have nothing of the kind. It would be highly valuable and interesting to have a collection of all the musical instruments ever heard or read of. There is an instrument we read of in Milton, when he speaks of "the jocund rebec's sound." Has any one living ever seen a rebec?

165. You may see a cast of one at South Kensington, brought from Exeter Cathedral.—I consider there ought to be such a collection in London.

166. You have of course heard of payment by results, as connected with primary education?—Yes.

167. Should you think it advisable to pay by results in musical education? as thus, supposing Parliament decided to give more money to the Academy, that the payment should be conditional on your proving your worthiness to receive it, by the proficiency of your pupils every year?—I think I do not see much objection to that, not to take it universally. In some years we turn out a larger number of good musicians than in others.

168. Do you think it would be acceptable to the Royal Academy that the amount of the Parliamentary grant should be dependent, in some way to be hereafter determined upon, on the successful results of the teaching?—Yes; I have no objection to that myself. If Parliament would interfere with us so much the better.

169. You would not object to a system of inspection?—Not at all.

170. Inspection and examination?—Not at all.

171. You would rather court it than otherwise?—Yes.

172. Do you make any use of the musical library of the British Museum?—We cannot take anything out of it. Some of the students go there to see any work they wish to consult. I have been there myself while Mr. Oliphant was the manager. It is not very available for our students.

173. Of what does a musical library consist, or of what ought it to consist?—For our purposes we want scores and parts of operas, symphonies, &c.

[The Committee adjourned.]

APPENDIX A.

Income and Expenditure of the Royal Academy of Music, in the Year 1864.

Receipts.		£	s.	d.
Annual subscriptions		263	7	0
Donations		163	6	6
Pupils' contributions—38 females; 21 males		1,768	8	9
Dividends on 3 per cent. consols (£1,700)		71	9	3
Government grant		500	0	0
		£2,766	11	6
Balance brought down		207	13	0

Expenditure.				£	s.	d.
Salaries, viz.:—Secretary	£158	8	0			
Governess	80	0	0			
Librarian	60	0	0			
Hall Porter	45	0	0			
Under Porter and Wife	70	15	6	414	3	6
Rent and taxes				294	12	0
Tuition				1,601	4	8
Repairs				33	8	11
Miscellaneous expenses, including coals, gas, advertisements, postage, stationery, and tradesmen's bills				215	9	5
				£2,558	18	6
Balance of receipts				207	13	0
				£2,766	11	6

APPENDIX B.

Prospectus of Royal Academy of Music.

The institution known as the Royal Academy of Music is the first successful attempt to establish a national school of music in England. That founded under the same name in 1720 did not pretend to be educational; the object then proposed being only the introduction and support of the Italian Opera, and it ceased as an institution in a few years.

Various other proposals appeared from time to time, but none came to maturity excepting this, which was founded under Royal and distinguished patronage in 1822, incorporated by Royal Charter in 1830, and recognised, as well as the Royal Academy of Painting, as a national institution for the cultivation of the fine arts, by a Parliamentary grant in furtherance of its objects.

Being thus established on a permanent basis, and having during the past forty-two years successfully shown, by the number of talented professors whom it has sent forth into the world, that the objects for which it was founded are being realised, and that a large amount of good to the art generally has been accomplished, as well as that the individual interests of the members of the musical profession have been materially improved, it is hoped that the Royal Academy of Music will receive liberal support from all who wish to promote, or are in any way interested in, the progress of music in this country.

From its commencement to the present time it has educated upwards of 1,300 students, 118 of these gratuitously, and 315 on terms reduced to meet the circumstances of those pupils who showed more than ordinary talent. Among those whom it has educated are some of the most distinguished composers, singers, and instrumental performers of the day; many of them having achieved an European reputation.

In order to continue these advantages to the art of music in this country, and if possible to enlarge the sphere of gratuitous instruction, the committee of management earnestly call on all the friends of the Institution, the professors of the different branches of the art, and the musical public generally, to come forward

with that liberal assistance which is indispensably necessary to enable them to carry out their future plans.

The Royal Academy of Music is under the especial Patronage of Her Majesty the Queen, their Royal Highnesses the Prince and Princess of Wales, and His Majesty the King of the Belgians.

The governing body is composed of a President, four Vice-Presidents, and a Board of Directors, from whom are elected a Committee of Management, who, with the Principal, superintend and regulate all the internal economy of the Institution.

The English and foreign professors employed are amongst the most eminent that can be met with in the various departments of instruction.

A resident matron presides over the young ladies' department.

The year is divided into three terms of thirteen weeks each, and the payment by each student is at present eleven guineas per term, with an entrance fee of five guineas. It is, however, proposed to form a junior department for less advanced pupils, who will be admitted into the senior department when fitted for it. The terms of payment for the junior department will be seven guineas per term, with an entrance fee of three guineas; and on their admission into the senior department, the additional two guineas completing the entrance fee is to be paid. Candidates for the junior department must have attained the age of ten years.

The funds for supporting the institution are raised by donations and subscriptions (her Majesty the Queen being an annual subscriber of 100 guineas), an annual Parliamentary grant, and the fees paid by the students.

All candidates for admission must previously pass an examination before the principal and professors appointed for that purpose, to show that they possess musical talent capable of cultivation; and to avoid unnecessary expense and inconvenience to candidates residing in the country, they may be primarily examined by any corresponding member, one at least of whom (a former student of the Royal Academy of Music) will be found in every principal town in the kingdom, and to whom a fee of five shillings will be paid by each candidate; or, in the event of such candidate being a chorister in a cathedral choir, a certificate from the organist will be accepted instead of such primary examination by a corresponding member.

There are two King's scholarships, a Westmorland scholarship, and a Potter exhibition attached to the Institution.

Gratuitous instruction in harmony and musical composition is given to such performers on wind instruments as may occupy, or may wish to occupy, the position of masters of military bands, in order that such persons may more efficiently qualify themselves for their duties therein.

All applications for admission to be made to the Secretary, at the Royal Academy of Music, Tenterden-street, Hanover-square, London, W.

Regulations.

1. All orders whatever for the government and regulation of the Academy emanate from the committee, whose orders are delivered, through their chairman, to the different officers of the establishment.

2. All branches of music are taught in the Academy. Should the particular branch for which the students enter be harmony, singing, harp, or pianoforte, the male students will be required to learn, in addition, any orchestral instrument the committee may require.

3. There are three terms in the year, Lent, Easter, and Michaelmas; with a vacation of four weeks at Christmas, a week at Easter, and a long vacation of eight weeks in summer. The payments are to be made in advance.

Student's Payments—Senior department, 33 guineas per annum, or 11 guineas a term.

Entrance fee, 5 guineas.

Junior department, 21 guineas per annum, or 7 guineas a term.

Entrance fee, 3 guineas.

One term's written notice must be given when a pupil is to be withdrawn, or a term's extra payment will be required.

4. Students will be admitted at the commencement of each term. Candidates for admission must attend for examination by the board of examiners on some day in the previous week to be duly advertised, and with a recommendation from a subscriber, honorary member, member, or an associate.

5. The students will be required to pay implicit obedience to all persons placed in authority over them, and to attend punctually the hours appointed for their instruction, and at all orchestral practices, rehearsals, and performances; they are also required to be present during the entire time of attendance of their various classes.

6. All students will be especially required to attend the orchestral and sight singing practices on Tuesdays and Fridays.

7. All students will be required to learn harmony and the pianoforte.

8. Advanced students will be required to give instruction in the Academy.

9. No student will be allowed to undertake any public or private engagement, without first obtaining the sanction in writing of the committee recommended by the principal, and signed by him and also the chairman, and dated when granted.

10. No student shall publish any composition without the sanction of the committee; and a copy of all compositions so published must be presented to the library of the Academy.

11. On leaving the Academy, the students admitted under the above regulations must undergo an examination. Should the examination prove satisfactory, they will receive a diploma, and, in special cases, the additional distinction of being appointed an Associate of the Institution.

12. Any infringement or violation of the regulations, or any discreditable or improper conduct, will subject the student, at the discretion of the committee, to be dismissed from the Institution; or an associate, to the erasure of *his* or *her* name from the register.

The above regulations are appointed by the committee and directors, acting under the charter given by his late Most Gracious Majesty, King George IV.

Signed, GEORGE CLERK,
Chairman of the Committee of Management.

APPENDIX C.

Arrangements of Classes and the Professors' Attendance for Easter Term, 1865.

MONDAY AND THURSDAY.

GOVERNMENT ROOM.

Signor Arditi.—Singing Class, 10 to 12.—Brougham, Cooper, Willis, Wynne.

Mr. Lucas.—Harmony, 2 to 3.—Buer, Cronin, Harriott, Williams.

CONCERT ROOM.

Mr. W. Macfarren.—Pianoforte, 9 to 10.—Bambridge (1 lesson), Kemp; 10 to 11·30—Buer, Harriot, Williams; 11·30 to 1—Eales, Tylee, McDonald.

Herr Pauer.—Pianoforte, 1 to 2—Henry.

Mr. Holmes.—Pianoforte, 2 to 4—Chatterton, Merriman, Vaughan, Vokins.

K. ROOM.

Signor Garcia.—Singing, 10 to 11—McCandlish, Horton.

Mrs. Netherclift.—Singing, 1 to 2—Buer, Harriott, Williams; 2 to 4—Kinkel, Piedra, S. Pitt, M. Pitt, Whyte.

I. ROOM.

Miss Whyte.—Singing, 10 to 11—Eales, Tylee, Townsend; 11 to 12—Henry, Lazarus, Odell; 12 to 2—Chatterton, Merriman, Vokins, Vaughan, Sharpe.

Mr. H. Thomas.—Pianoforte, 2 to 4—Brougham, Cooper, Wynne, Watts, Willis, Horton, Townsend.

J. ROOM.

Miss Zimmermann.—Pianoforte, 10 to 11·30—S. Pitt, M. Pitt, McCandlish.

Mr. Lunn.—Harmony, 12 to 2—Brougham, Cooper, Wynne, Sharpe, Vaughan, Whyte.

Mr. Westlake.—Pianoforte, 2 to 4—Lazarus, Odell, Sharpe, Whyte.

COMMITTEE ROOM.

Herr Goldschmidt.—Pianoforte, 12 to 3—Hall, Jarratt, Thouless, Kinkel, Kingdon, Piedra.

B. ROOM.

Mr. W. Wells.—Singing, 11·30 to 12—Bell.

Mr. Holmes.—Pianoforte, 12·30 to 2—Bell, Johnson, Heywood.

C. ROOM.

Mr. Westlake.—Pianoforte, 1 to 2—Ralph, Rich.

TUESDAY AND FRIDAY.

CONCERT ROOM.

Sight Singing Class for all the Students, 1 to 2; Orchestral and Choral Practice, 2 to 4, for all the students, under the superintendence of Mr. Lucas.

Mr. Lacy.—Elocution, 10 to 1—Haines, Isaacs, McCandlish, McDonald, M. Pitt, Willis, Wynne, Bauermeister, Bradshaw, Brougham, Chadwick, Cooper, Forsith, Greenaway.

Gentlemen's Class.—Wells, D. Smith.

K. ROOM.

Signor Maggioni.—Italian Language, 10 to 12—Bauermeister, Bradshaw, Brougham, Chadwick, Cooper, Forsith, Greenaway, Haines, Isaacs, McDonald, Wynne, McCandlish, S. Pitt, Willis.

I. ROOM.

Dr. Steggall.—Harmony, 10 to 12—Chatterton, Eales, Gibbons, Lazarus, Merriman, Odell, S. Pitt, M. Pitt Severn.

J. ROOM.

Mr. Bannister.—Harmony, 11 to 1—Chatfield, Hendry, Piedra, Tylee, Kemp, Pettitt, Smith.

COMMITTEE ROOM.

Mr. G. Macfarren.—Harmony, 10 to 12·30—Bambridge, Bell, Elliott, J. Jackson, Thouless, Kinkel, Kingdon, Johnson, McDonald.

B. ROOM.

Mr. Goss.—Harmony 12 to 1—Hull, Ralph, Snewing, J. Jackson.

Mr. Horton.—Oboe, 11 to 12—J. Jackson.

C. ROOM.

Mr. Folkes.—Violin, 11 to 1—Elliott, Mountain, Clement, Couldry, Kemp.

Mr. Turner.—Harmony, 9·30 to 10·30—Mountain, Rich, Heywood, Couldery.

A. ROOM.

Signor Maggioni.—Italian Language—Gentlemen's Class, 9·30 to 10—Hamilton, Wells, Smith.

Mr. Aylward.—Violoncello, 12 to 1—Bambridge.

Mr. Lazarus—Clarionet, 11 to 12—Hallett.

G. ROOM.

Mr. Watson.—Violin, 9 to 11·30—Bell, Dewberry [viola], Heywood, Johnson, Junatt, Pettit [viola], Thouless [viola].

WEDNESDAY AND SATURDAY.

CONCERT ROOM.

Mr. Dorrell.—Pianoforte, 9 to 12—Elliott, Fox, Mountain, Gibbons, Severn, Bryant.

Mr. Cusins.—Pianoforte, 2 to 4·30—Bauermeister, Martin, Dewberry, Jackson, Couldry.

K. ROOM.

Mr. O'Leary.—Pianoforte, 9·30 to 12—Chatfield, Johnson, Isaacs, Forsith, Chadwick, Wells, Clement.

Mrs. O'Leary.—Singing, 12 to 1·30—Bryant, Martin, Chatfield, Johnson, Severn.

I. ROOM.

Miss Gimson.—Pianoforte, 2 to 3—Greenaway, Bradshaw.

J. ROOM.

Mr. Banister.—Harmony, 12 to 2—Greenaway, Martin, Bradshaw, Bryant.

Mr. Banister.—Wednesday—Bauermeister, Chadwick, Forsith, Isaacs, Bradshaw.

Mr. Banister.—Saturday—Greenaway, Martin, Bryant.

COMMITTEE ROOM.

Signor Schira.—Singing, 10 to 3—Bauermeister, Greenaway, Haines, McDonald, Chadwick, Forsith, Isaacs, Bradshaw, Hamilton, C. Harper, H. Harper, Wells, Smith.

B. ROOM.

Dr. Steggall.—Organ, Wednesday, 9 to 12·30—Kingdon, Gibbons, Bambridge, Eyers, Fox, Pettit, Thouless.

Mr. Eyers.—Pianoforte, 1 to 2·30—Smith, J. Jackson, Pettit.

C. ROOM.

Mr. Mason.—Pianoforte, 11 to 12—Snewing, Hallett.

A. ROOM.

Mr. Sainton.—Violin, 11 to 11·30—Ralph, Snewing, Jackson.

G. ROOM.

Mr. Lucas.—Harmony, 12 to 1—Couldery, Dewberry, Fox, Jackson.

Mr. Radclif.—Saturday, Flute, 2 to 3—Rich.

The tuition given to each student per week is as follows:—

Ladies.—If the principal study be the pianoforte, the student has two lessons of half-hour each on that instrument. Second study—two lessons in singing of twenty minutes each. Harmony—two lessons in classes of four to the hour. All students are obliged to attend the singing class and the orchestral and choral practices twice a week. If the principal study be singing, the student has two lessons of half-hour each. Second study, pianoforte—one lesson of half-hour. Harmony—one lesson in classes of four to the hour. Italian language—two lessons in classes of six to the hour. Sight singing and orchestral and choral practices as above.

Gentlemen.—If the principal study be violin, or any other orchestral instrument, two lessons of half hour each. Second study, pianoforte—two lessons of twenty minutes each. Harmony—two lessons in classes of four to the hour. Sight-singing and orchestral practices. If the principal study be pianoforte, two lessons as above, and second study some orchestral instrument. Harmony as above. Sight-singing and orchestral practices. If the study be singing, the same course is adopted as before mentioned. Although each student only receives individual tuition, as stated above, all the students are required to attend their masters in classes of four and remain during the whole time of each class, consequently they have the advantage of hearing the remarks made to others. Some students, in addition to the above, receive lessons on the organ. All have the use of the music contained in the library of the Academy.

Proceedings of Institutions.

Alton Mechanics' Institution.—The twenty-seventh annual report says:—The committee have reason to believe, that notwithstanding they have to acknowledge a falling off in the number of members, the Institution continues in a healthy working condition. Of quarterly members there are 14 less than last year, and 33 less than the year before. There has been an addition made to

the library of 48 volumes, bringing the total number up to 1,671, and besides these, 19 new volumes have been purchased to replace old ones which have been entirely worn out in the service. The issues of books for the year have been 2,559, or on an average about 49 per week. The lectures were 15 in number, and amongst them may be mentioned:— One on "Mahommed, his Words and Works," by W. Dowling, Esq., of the Inner Temple; one on "The Importance of an Acquaintance with Elementary Science," by J. C. Buckmaster, Esq., from the Science and Art Department; two on "Milton, his early Life, Times, and Poetry," by the Rev. J. T. Plummer; one on "Fishes, Fossil, and Recent," by Waterhouse Hawkins, Esq.; one on "The Life Boat, and her Works of Mercy," by the Rev. N. H. McGachen; one on "The Romance of the Bourbon Family," by Dr. J. C. Daniel; and one on "Adam Bede," by G. Grossmith, Esq. The number of subscribers amounts to 226, viz.:—Annual subscribers of 10s., 45; ditto of 1 guinea, 52; quarterly subscribers, 106; ditto who have paid part of the year and have left, 30. The statement of accounts shows that the expenditure has amounted to £155 0s. 5d., and that there is a balance due to the secretary of £13 15s. 5d.

Pembroke-Dock Mechanics' Institute.—The fourteenth annual report says that in the condition of the Institute there is a steady improvement. The total number of members was 285, showing an increase of 13 during the twelve months. The library for circulation consisted of 2,090 volumes—101 of which had been added during the year. Upwards of 60 members have, since 1862, kindly volunteered an annual subscription of two shillings, in addition to their regular subscription, amounting to £16 2s. 6d., to be devoted entirely to the building fund. In reference to the annual examination by the Society of Arts, the Committee feel much pleasure in testifying to the increasing interest taken by the members in these educational tests; and, if an educational scheme, in connection with the Institute, were properly developed, a still further increase in the number of candidates would ensue. The balance sheet shows that the income was £118 5s. 6½d., and that there was a balance in hand of £9 13s. 1d.

Redditch Literary and Scientific Institute.—In the last report the abstract of accounts shows a balance due to the treasurer; but the money has been expended specially in the library department, for requirements not likely to occur again. The lectures have produced a profit, instead of a heavy loss, as in the previous year's account. The library has been increased, thoroughly re-arranged, and the books repaired, covered, and newly numbered; also new catalogues have been printed. The total number of volumes is now 1,074. The issues this year have been only 1,632, a decrease accounted for by the library having been closed about ten weeks, in consequence of the re-arrangement. The Working Men's Branch is progressing most satisfactorily; the newspapers and magazines supplied to that department have been increased. The Saturday evening entertainments have rather increased than diminished in popularity and in prosperity. A very successful effort has been made in a new direction—the establishment of science classes. In the first session 13 pupils (out of 14 candidates) passed a Government examination; and about three times that number have attained such a stage on the road to scientific knowledge as will most probably lead them on to further efforts. The expenditure has amounted to £139 1s. 3d.

EXAMINATION PAPERS 1865.

(*Continued from page* 562.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

ELECTRICITY AND MAGNETISM.

THREE HOURS ALLOWED.

1. Describe the best construction of a mariner's compass. How are the needles best arranged, and why?
2. How have the diurnal changes in the earth's magnetism been accounted for?
3. Explain experimentally the phenomena of diamagnetism.
4. State the theory of electricity which you consider most in accordance with the present state of knowledge, and mention some experimental illustrations.
5. Distinguish between an electrometer and an electroscope, and describe the condensing electroscope.
6. Explain the conditions of efficiency in a lightning conductor.
7. In what respects does the electricity evolved from a machine differ in quality from that of a battery, and how may they be shown to be identical?
8. What is a *so-called* astatic needle, and what position will it assume when the two needles are exactly equal in force?
9. Explain the construction and use of a tangent-galvanometer.
10. Explain the cause of the rotation of a current round a magnet, or *vice versâ*.
11. Describe the construction of any magneto-electric telegraph.
12. Explain the construction of a submarine cable, and the method of testing its insulation.
13. How is an induction-coil machine constructed, and by what special apparatus may the shocks be intensified?
14. Explain the process of electroplating.
15. By what means can the current be most economically produced for electro-metallurgy on the large scale?
16. What phenomena result from the transmission of a current through a living compound nerve?
17. What electric phenomena are manifested by portions of nerve and muscle of a recently killed animal?
18. What is the peculiar character of thermo-electric currents, and by what means can they be most readily produced?

LIGHT AND HEAT.

THREE HOURS ALLOWED.

Geometrical Optics.

1. Give the definitions of a beam of light, a ray of light, and a pencil of rays. Trace the visual pencil, or the pencil of rays by which the image is seen, when an eye in a given position sees the image of an object which is formed by a *plane mirror;* showing the form and position of the image from the law of the reflection of light, and stating whether the image which is seen is real or virtual.
2. Show how the image of an object is formed by *a concave* spherical mirror, both when the object is near the mirror and when it is distant. Show that the image of an object formed by *a concave* mirror is sometimes real and sometimes virtual, and show the circumstances in each case. Show how a combination of a concave mirror, a plane mirror, and an eye-lens constitute the Newtonian telescope, and show how the magnifying power is found.
3. Show how *the refraction* of light at *a convex* spherical surface of a dense refracting medium forms an image of a distant object within the medium. Apply this discussion to explain the formation of an image upon the retina of the eye, supposed in the first instance to be of a homogeneous structure. What discussions have arisen to explain why we see objects erect, when the image formed upon the retina is inverted?
4. Explain what is meant by an *achromatic* lens; and show how the achromatism is produced. State the advantages possessed by achromatic telescopes and microscopes over the simple forms of these instruments.

PHYSICAL OPTICS.

5. Explain what is meant by a beam of *plane polarized* light, and show the various methods by which such beams can be obtained. Explain the modes of testing the polarization. What is the state of the polarization of the two rays, which, originating in a ray of common light, have traversed a double refracting crystal?

6. Explain what is meant by the colours of *thin plates*, and show how the colours of the soap bubble, and of *thin films* of refracting substances generally, are explained on the doctrine of the interference of light. Describe some cases which occur in common experience where such an explanation will apply.

7. Describe the appearances seen when we place *a hair of the head* before the pupil of the eye, and look towards a distant lighted candle; these appearances being more distinct when we look through a pin-hole in a card, or a narrow slit parallel to the hair. Give the explanation of the phenomena which are seen.

8. Show the arrangements which are necessary in the polarizing microscope, and state how the phenomena which are seen in the field of view arise. Give some examples of objects which are proper for the polarizing microscope.

HEAT.

9. Give the distinction between *the temperature* and *the latent heat* of a body. If steam, and the water from which it arises, are of the same temperature, explain what amount of heat (or, better, of caloric as the cause of heat) has been required to change the water into steam. When the steam is condensed into water again, what amount of heat does it give out?

10. Describe the construction and graduation of the *common mercurial* thermometer; and show how to compare the different scales of degrees which have been used. When the temperature is 80° in England, what would it be called in France?

11. State the ordinary law of the *increase of volume* of the gases under constant pressure for increase of temperature. Does the same law apply to super-heated steam when removed from contact of the water from which it is produced; and to the vapours of the liquids generally, in similar circumstances?

12. Explain *the principle* of the construction of the double-acting condensing steam engine; and show how the communicating and abstracting of heat produces the mechanical force which is developed.

CHEMISTRY.

THREE HOURS ALLOWED.

No candidate is allowed to answer more than three questions in each division.

FIRST DIVISION.

1. 100 cubic centimetres of air (6·10271 cubic inches) are mixed with 50 cubic centimetres of hydrogen at 15° C. What will be the volume of the residual mixture after explosion, at the same temperature and pressure?

2. Describe the construction and working of an apparatus for the preparation of pure and dry hydrogen. Explain by symbols the chemical changes which occur in the process.

3. How is ammonia obtained from crude coal gas? Describe and explain the chief reactions of ammonia.

4. How is marsh-gas obtained in a state of purity? How much heavier is it than hydrogen? How can you distinguish and separate it from olefiant gas?

5. Describe and explain the action of chlorine on a concentrated solution of potassic carbonate, also its action on slaked lime.

6. How would you prepare pure silica from an insoluble silicate such as felspar?

SECOND DIVISION.

1. An alloy of antimony and lead is given. How would you prepare pure metallic antimony from it?

2. A sample of copper is suspected to contain arsenic. How would you proceed in order to decide whether arsenic is contained in it?

3. Describe the action of sulphuretted hydrogen on aqueous solutions of the following compounds separately, viz., antimonious acid, corrosive sublimate, chromic acid, ferric chloride susquichloride of iron[a], supposing that each of the solutions contains free hydrochloric acid. Explain the action in each case by an equation.

4. Explain the manufacture of white lead.

5. How is aluminium prepared? What alloy of aluminium is chiefly made?

6. How is caustic potash usually prepared? What are its chief impurities? How can the alkali be obtained pure?

THIRD DIVISION.

1. How is vinegar usually made? how purified? Describe the compounds of acetic acid and lead, giving their formula.

2. Describe and explain the process of etherification, giving the formula of the substances which take part in it.

3. What decomposition does benzoate of lime undergo when subjected to dry distillation? What is the decomposition when it is distilled with hydrate of lime?

4. How can pure uric acid be obtained from guano?

5. How would you test for cane sugar in the sap of a plant?

6. Describe the formation and properties of some compounds of metals with alcohol radicals, and show in what manner their constitution decides the atomic weights of the metals contained in them.

(To be continued.)

PARIS UNIVERSAL EXHIBITION OF 1867.

The Emperor has just issued the decree approving the decisions of the Imperial Commission relative to this next great exhibition, which is to include Art, Agriculture, and Industry.

It is decided that it shall take place in the Champ de Mars, in a temporary building, surrounded by a park, destined to receive living animals and plants as well as objects too large or unfit for exhibition within the building. The exhibition is to open on the first day of April, and to close on the last day of October, thus extending its duration to seven months. Some of the regulations are of a novel character and deserve notice. In the first place, a committee is to be appointed immediately, to make the exhibition, its objects, and regulations known thoroughly throughout the provinces of the empire; to make out, by the end of October in the present year, a list of the principal artists, agriculturists and manufacturers whose aid will be valuable to the exhibition; to induce preliminary local exhibitions of agricultural products in each department; to form a commission composed of scientific men, agriculturists, manufacturers, foremen and other persons to study these exhibitions and report on the use which may be made of the information thus obtained; to arrange for the collection of funds for aiding the working classes in visiting the exhibition, and for the publication of the reports mentioned above.

It is announced that the official catalogue will be composed of two portions, to be arranged alphabetically, one part in the order of exhibitors names, the other in that of objects, and on this account the materials for the catalogue, foreign as well as French, are to be supplied by the end of the present year.

The classification differs considerably from that of former exhibitions, and is divided into ten groups and ninety-five classes. The first group comprises the fine arts. The second group consists of the materials and applications of the liberal arts:—Printing, stationery, industrial art, photography, music, medical, mathematical, and scientific instruments, maps, geographical and educational apparatus. The third group includes furniture, linen, &c.,

paper hangings, plaster and other ornaments, glass, porcelain, carpets, cutlery, goldsmiths' work, bronze, clocks and watches, apparatus for lighting and heating, perfumery, and small wares. The fourth group comprehends all objects of personal wear and decoration, including tissues, cotton, linen, woollen, and silk shawls, lace, hosiery, jewellery and other ornaments, arms, travelling equipments and toys. The fifth group includes mining and mineralogy, iron and steel wares, forest produce, animals, implements, and produce of the chase and fisheries, and of uncultivated lands, agricultural, chemical, and pharmaceutical productions, materials for, and products of, dyeing and printing, dressed firs and skins. The sixth group is to consist of instruments and processes of ordinary art, metallic, rural, agricultural, alimentary, chemical, &c., motive and other machinery, and tools of all kinds, carriages and carriage making, saddlery, railway and telegraphic plant, instruments and processes, civil engineering and public works, and maritime matters. Group the seventh takes in alimentary substances, fresh or preserved condiments and other stimulants, wine and other drinks. The eighth group includes living products, and the material of agriculture, useful insects, fish, &c. The ninth is devoted to horticultural products and materials of all kinds. The tenth and last group is to consist of objects exhibited with special reference to the material and moral welfare of the great mass of the population, and is to include matters connected with education, habitation, clothing and food, and amongst other things a collection of the costumes of all nations, with special reference to climate, profession, economy, and health, and an exhibition of the tools, processes and products of working men, who carry on their business with the aid only of their own family or of an apprentice, in relation with the objects of this group.

It will be observed that the classification does not comprise military and naval armaments; and, it may be added, that the commissioners express a desire to make any such alterations in their programme generally as may hereafter seem desirable, and, in fact, invite suggestions on that head.

As regards works of art, only those produced since the 1st of January, 1855, are admissible.

All objects are to be exhibited under the name of the producer, but the name of a regular agent may be added by permission of the exhibitor. Merchants and others will, however, be permitted, by special order, to exhibit products not shown by their manufacturers.

Cash prices may be affixed to the articles, and in the case of the economic furniture and clothing class, this is obligatory.

Each exhibitor will have the right to a card of admission to the exhibition, and recognised agents will be placed on the same footing.

The rates of admission, and what medals or other prizes are to be awarded, will be announced hereafter.

A scientific commission, to report, in concert with the juries, on the various classes of the exhibition; the delivery of lectures, for which a theatre is to be provided near at hand; and classes for study, form part of the scheme.

To avoid delay and incompleteness at the time of the opening of the exhibition, the Imperial Commission has adopted a system differing in several respects from those which have hitherto prevailed. These changes will be best indicated by the following extracts from one of the schedules attached to the report:—Notification of the amount of space to be allotted to foreign states is to be given before the fifteenth of next month. The outline plans of each foreign commission to be sent in before the end of October, and all the details before the end of January, 1866. The building and park to be finished by the first of December next year. All the stalls and fittings of exhibitors to be finished by the middle of January, 1867. All goods to be delivered within the exhibition building between the 15th of January and the 10th of March. Everything to be in its place by the 28th of March; the two following days to be devoted to a thorough cleansing and brushing up of the whole exhibition; and the last day of March to a complete official review of the whole.

It will be perceived that two points which have been already much discussed are left untouched in the report, namely, the proposed arrangement of the exhibition in such a manner as to present both a geographical and a systematic classification; and the entire avoidance of galleries, and consequently of staircases.

Fine Arts.

Fine Art Exhibitions in the French Provinces.—The growth of provincial exhibitions of works of art in France is one of the most remarkable facts of the day and shows how the love of the beautiful is spread over the whole country. Almost every week brings the announcement of a new one. Amongst those which have taken place, or are arranged for the current half-year, are those of Alençon, Bordeaux, Marseilles, Lyons, Nantes, Nimes, Niort, Spa, Toulouse and Versailles. As these provincial exhibitions are held at various seasons—that of Lyons, one of the most important, opens in the latter part of December or the beginning of January—artists are able to send their works to two or three in the same year. To give an idea of the pecuniary effect of these provincial exhibitions with respect to artists, it may be mentioned that during the late exhibition at Bordeaux the purchases reached £2,639 in amount. The authorities of the town expended £256 for two pictures and three bronzes for their museum; the Society of the Friends of Art, by which the exhibition is managed, £880; and private individuals £1,500. Many of the works purchased, which numbered more than a hundred, were by Parisian artists, or artists well known in the Paris world of art, such as Antigna, Barye, Blin, Brown, Mène, Rousseau, Boulangé, Chaplin, Corot, Fromentin and Landelle; but still more were by artists yet but little known beyond the provinces. To them these provincial exhibitions are of immense service, not only for the sale and exhibition of their own works, but on account of the opportunity they afford of seeing them exhibited side by side with those of artists of acknowledged standing and celebrity.

New Process of Picture Cleaning.—The *Pall-mall Gazette* says:—Oil pictures of ancient date become clouded by dust deposit; this can be wiped off. They also are obscured by an opacity in the varnish surface; this can be scraped away, but rarely without serious detriment to the picture. Too many flayed and glaring wrecks of what were once noble efforts of pictorial art exist to warn the artist covetous of immortality; but Professor Pettenkofer's process gives us hope that their numbers need not be increased—that the picture-cleaner's noxious vocation will soon be superseded. Science has disclosed the true means of restoration. The opacity of the varnish arises from a molecular change; the resinous particles of which it is composed becomes displaced in course of time, and when so displaced their transparent quality is lost. These atoms, once restored to their original cohesion, recover lucidity; and this can be effected by exposing the surface of the picture to the fumes of alcohol. The spirit, when absorbed, evaporates; the varnish coating has received new life, and is left as hard as it was before—perhaps harder. The hand of man throughout the operation has never approached the surface of the picture. Professor Pettenkofer has patented this application of alcohol, and the apparatus by which it is effected, but with great liberality he placed it freely at the disposal of the authorities of the National Gallery. After preliminary experiments, it has been tried with complete success, under Mr. Wornum's personal superintendence, on sixteen of the pictures in the public collection. "With such results," our authorities consider it "but just to the liberal and

scientific inventor to express a favourable opinion as to the utility of the process;" though they have no better means of advertising their opinion of its merits than an unread appendix to this year's estimates.

Manufactures.

China Grass.—The regular introduction of this fibre into manufacture is being steadily pursued in France. In the *Journal* of the last week of 1864, page 110, will be found an account of the experiments recorded up to that time. The subject has now been pushed some steps further, and the new results, although apparently highly satisfactory, exhibit modifications of former statements well deserving the attention of the manufacturing world. M. Ch. Legheer, cotton spinner, of Laval, has produced eight pieces of coutil, white and dyed of various colours, for trousers, which are pronounced excellent, the stuff being peculiarly silky, and the colours fresh and pure. These tissues are composed of mixtures of jumel cotton and China grass in the proportions of 50 per cent. of the latter fibre in the warp, and 60 per cent. in the weft. M. Legheer has recorded the results which he has obtained in a letter, of which the following extract contains the principal points. He declares that there is scarcely any waste whatever in the working of the China grass; that it works perfectly with the ordinary cotton spinning machinery; that it may be advantageously used as a substitute for cotton to the extent of from 60 per cent. to 75 per cent., and that the beauty and regularity of the tissue are most remarkable. The weaver who produced the specimens alluded to has offered to take all the China grass yarn that M. Legheer can produce for the next six months, to the extent of a ton a day, and M. Legheer, on his part, expresses his readiness take a very large quantity, and to devote himself entirely to the spinning of it. As regards the cottonization, to use the expression of the writer, it is performed perfectly well by the ordinary carding machinery (*batteurs-cardeurs*), at the rate of from three to four hundred pounds per day. Moreover, M. Legheer says that when he can secure a good supply of the China grass he is convinced he can spin it without any mixture of cotton whatever, and produce yarns which will leave nothing to be desired. He does not, however, regard the fibre as a complete substitute for cotton, but believes it might advantageously replace the latter to the extent of from 60 to 75 per cent. Now comes the great question of cost and economy. The following are the results made known to the public. The expenses of working, dyeing, and bleaching cotton grass cloth, are said to be the same as for the same kind of fabrics composed of flax or cotton. As regards the material itself, it is said that while a tissue of pure cotton costs about 6f. 07½ per kilogramme, one composed of half cotton and half China grass comes to 4f. 72½, and a tissue composed of the latter fibre alone would only cost 3f. 25 per kil. It is here observed, however, that the China grass at present employed is heavier than the cotton, but Messieurs Mallard and Bonneau, who supplied M. Legheer with the material, state that by carrying the operation of preparing the fibre a little further, they can produce it of the same lightness as cotton. But the question naturally arises whether such improvement in the preparation will not seriously alter the figures of the above estimate. The Chamber of Commerce of Rouen has pronounced most favourably on the fabrics composed of the mixed fibres, and all the world is acquainted with the fine tissues which have been produced, but nothing but practical experience on a large scale will settle the economic problem. M. Legheer's confident assertion respecting the absence, or almost entire absence, of any waste in working the China grass, is certainly a point of great importance, and is estimated as giving it an advantage, under this head, ranging in value from 10 to 25 per cent., as compared with cotton of different kinds. M. Paul Dalloz, in commenting on these reports in the *Moniteur*, says, with reference to the absence of waste:—"And we had already counted on this waste for the manufacture of paper! Will China grass rob us of this hope? If so we beg Messieurs Mallard and Bonneau to try their methods of preparation on some other plant, the commonest in our fields, furze for instance, and furnish our paper mills with the raw material, which shall deliver us from the paper loaded with duty, with which the printing office has been so long afflicted." M. Dalloz's appeal will produce a crop of sympathy in all the printing offices in the world, and perhaps eventually the gentlemen he appeals to, or some one else may supply the desired raw material, but it is not found yet. However, every little helps, and possibly repeated demands may have some effect. The Senate recently received a petition on the subject from seventy-nine paper makers, which was reported upon by M. Le Roy de Saint Arnaud, and referred to the Minister of Agriculture and Commerce. Promising as are the reports concerning the utility of China grass, not only for light gauzy articles, but for the production of solid tissues for ordinary wear, the grand problem of a good supply of the raw material remains, unfortunately, at present unsolved. Possibly the necessary supply may be obtained from India and China, in which case there is nothing more to be said, except indeed it can be produced nearer home more, or even as economically. Algeria offers one of the best chances of a supply of the fibre, and the Emperor paid considerable attention to the subject during his recent visit to his African dominions; and it is said that experiments made near Paris prove that the plant could be easily acclimatized in France. With the view of testing the questions both of production and manufacture, a society, composed of some of the most influential persons in the cotton trade, and in connection with a banking firm of high standing, has, it is said, been formed, which will supply capital to agriculturists for the special purpose in view, and also establish a factory near Rouen for the preparation of the fibre. There is no doubt that the matter is one of great importance, and it will be of great service to commerce and manufactures if the efforts of the company should be crowned with success.

Exhibition of Industrial Art. — The preparations for the Exhibition of Industrial Art, which is to open on the 10th of August this year in the Palais de l'Industrie in the Champs Elysées, under the management of the "Union Centrale des Beaux Arts appliqués à l'Industrie," whose establishment in the Place Royale has been noticed in the *Journal*, promise good results. The applications for space are very numerous, and there is no doubt that it will be by far the best exhibition of its kind that has been held in Paris. As already stated, it will include not only contemporary but retrospective art, and the contributions of collectors towards the latter promise to render it highly interesting. The plan adopted is to confine the works of the present day to the ground floor, and those of the past to the galleries. With the view of rendering the connection between the two floors more easy, a grand staircase is now in course of construction which will give direct access to the galleries from the centre of the nave, and thus, as it were, invite the public upstairs, and save visitors a search for the staircases, which at present are hidden in the angles of the building. This matter was well worth the attention of the managers, who have therein shown an enlightened regard to the value of easy and evident modes of ascent and descent. The Palais de l'Industrie is unfortunately constructed; the galleries are very wide in proportion to the building, and consequently a very large portion of the lower floor is ill-lighted. The new exhibition building, to be used in 1867, is to be entirely without galleries, and there is no doubt that the convenience and general aspect of the exhibition will be immensely improved by their absence.

Colonies.

The following is a summary of the latest Australian intelligence, as given in the Messrs. Silver and Co.'s Emigration Circular, just published:—

Victoria.—Population on 31st March, 610,250, showing increase of 5,192 on first quarter of the year. Land occupied on 31st March, 6,064,963 acres, first selection made under the new Act. Colonial defence, water supply, and mining bills before Parliament. Establishment of a branch of the Royal Mint proposed. Abundant rain causes active operations on gold fields and agricultural lands. A 70 oz. gold nugget found at Bendigo. An explosive compound—said to have advantages over gunpowder—patented. Slate, fit for roofing purposes, discovered at Castlemaine. Competent female servants much in request.—May, 1865.

New South Wales.—Seasonable rains for agricultural operations, causing abundance of pasture, and favourable reports from most of the country districts. £40,000 voted for emigration, and £2,500 for sinking wells on the Darling and Lachlen. Another oil-yielding mineral discovered at New Hartley.—May, 1865.

South Australia.—Colony in highly prosperous state. Revenue for quarter ending 31st March, £213,848; very large surplus in land. The question of making Adelaide a free port under consideration. Excess of immigration, over emigration, since commencement of the year, 1,341, but immigrants still very much wanted; large votes being passed and Government desirous of having two ship-loads per month. Copious rains making farmers very busy. Several new hundreds declared, and surveying rapidly progressing. New road bill prepared. Railways on lease submitted for tenders. The central part of colony to be called Alexandria Land.—May, 1865.

Queensland.—Mail service *viâ* Torres Straits asked for. Large cotton yield expected; picking commenced. Restrictions on importation of stock about to be removed. —May, 1865.

New Zealand.—Wanganui campaign closed. Wellington exports for quarter ending March 31st, £111,702; imports, £58,029. Trade improving, many buildings in course of erection, and general prospects have a promising aspect in Wellington. Land for sale in the northern provinces, being surveyed. Okitiki digging yielding largely; new mines discovered. Railway proposed from Picton to Blenheim.—May, 1865.

Salmon in Tasmania.—It has been stated that although 2,000 of the ova placed in the ponds in the River Plenty were successfully hatched into living fish, they have since been reduced to below 500, owing to mortality and the destruction by water rats, so that the great salmon acclimatization experiment is not now so cheering as it was once considered.

Notes.

Fishing by the Electric Light.—The *Courrier de Brétagne*, a paper published at Lorient, gives an account of an experiment made recently at Belle-Isle to fish at night by means of electric light. The light was produced by a powerful electro-magnetic machine, constructed by M. Bazin, the well-known engineer. The experiment, which was conducted by M. Bazin on board the *Andalouse*, in the presence of 1,500 persons assembled on the pier, was completely successful, and the quantity of fish taken very large. As soon as the submarine lantern was immersed, shoals of fish of every kind came to sport in the illuminated circle, while the fishermen outside it spread their nets from their boats. The light illuminating the deep sea, the fish arriving in shoals, attracted by the fictitious sun, the boats at the edge of the lighted circle, the deep silence, interrupted only by the working of the electro-magnetic machine, is described as an imposing sight. It is said that M. Bazin is shortly to proceed to Bona, in Algeria, to established a coral fishery by the assistance of his electric light. He proposes in the meantime to descend 400 feet into the sea and explore with his submarine instruments. The Minister of Marine has given orders for a ship of war to be placed at his disposal, and Admiral Choppart has appointed a commission, composed of engineers and naval officers, to attend M. Bazin's experiments officially.

Fatal Effects of Lightning in France.—M. Boudin has recently presented a report to the Paris Academy of Sciences, on the accidents caused by the electric fluid. It appears that during the years from 1835 to 1863 inclusive, 2,233 persons were killed instantaneously. In many instances where the lightning struck mixed groups of persons, it was observed the males suffered far more than the females. M. Boudin contradicts the assertion, which has been made and repeated with much confidence, that the beech tree is never struck by lightning, and declares on the contrary that many instances have been recorded of such accidents. Of thirty-four persons killed in the fields by lightning, in the year 1853, fifteen were struck when sheltered beneath trees; while, during the years 1841 to 1853, out of a hundred and seven killed in the fields, only twenty one were reported to have been near trees. Some of the cases which have occurred this year in Paris were very terrible. Two men were passing along the Rue du Rocher in a covered cart, such as is used to convey linen to and from the wash; the lightning struck the vehicle, killed one of the men and the horse on the spot, melted some of the iron work of the cart, but left the other man completely uninjured.

A Mathematical Caricaturist.—M. Gavarni, the celebrated artist, whose clever illustrations are known almost as well in London, where he resided for some time, as in France, has just presented to the Academy of Sciences of Paris a treatise on mathematics.

Correspondence.

Trade Marks.—Sir,—When, some time since, I had the honour of addressing you on the subject of trade marks, the statute affecting them had not been enacted, and it was then not too late to entertain hopes that some provision might have been introduced into it for a system of trade mark registration. The Act, however, has been passed without any such provision, and I anticipate that, before long, practical difficulties will arise in its application and working, and considerable litigation will ensue. Already persons appear dissatisfied with a protection which is weak, from what I may call essential defects. It is true that the extraordinary and unnecessary severity of the penalties which the Act imposes—a severity more in accordance with French than with British jurisprudence —renders the operation of the law almost nugatory. But, were this otherwise, there would still remain serious difficulties in the way of its operation, and grave drawbacks to its success. It seems difficult to believe that there is actually no register of reference which persons might consult to ascertain whether they are transgressing or not. A man may be at a considerable expense in having dies of particular trade marks made, and goods marked with them, and may afterwards learn the agreeable fact that the same marks, or something very like them, had already been appropriated by other persons. Machinery for registration already exists at the Design Office, and arrangements might be made there for recording trade marks without much (if any) increase of the present staff. Again, according to the very large, or liberal, words of the Act, a dot or line might be a trade mark; there is no real definition of what is to constitute a substantial or distinctive trade mark. It would assuredly have been

wiser had the statute contained some sort of general definition of the essentials of a trade mark, or at least some provision for such eventual definition, by administrative or ministerial rather than judicial decision, in case of need. Indeed, such decision might have been safely left (even without ready appeal) to the judgment of an intelligent and discreet registrar, seeing that, in few cases, would intrinsic rights have been prejudiced even by an adverse decision, the case differing from that of copyright in design. The manufacturing and commercial classes generally—with the exception, perhaps, of Birmingham manufacturers—do not appear to take great interest in the Act as yet. A member of your Society, Mr. Edmund Johnson, certainly endeavoured to call their attention to its provisions. If the question be thoroughly ventilated and considered, I believe the new Parliament would be urged to introduce certain modifications in this statute, in the directions which I have ventured to indicate, viz., by establishing a system of centralised registration, by defining, or appointing officers to define, the essentials or composition of a substantial trade mark; and by rendering the penalties more consonant with English notions, and sufficiently appropriate to the offence, to induce their infliction in ordinary course.—I am, &c., M. Henry.

Fleet-street, July, 1865.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par.
Num. *Delivered on 4th July*, 1865.

324. East India Sanitary Commission, &c.—Letter.
393 (1). Referees on Private Bills—Index to Report.
406. Fire Insurances—Account.
River Plate, &c.—Correspondence respecting Hostilities (Part III.).
Manufactures, Commerce, &c. (No 10)—Reports by Her Majesty's Secretaries of Embassy and Legation.

Delivered on 5th July, 1865.

319 (1). Prison Ministers' Act—Further Return.
373. Rangoon and Western China—Memorandum by Captain Williams.
322. Charities—Return.
400. Shannon River—Report and Evidence.
431. Dublin Corporation Waterworks—Return.
North America, No. 9 (1865)—Further Correspondence respecting the Cessation of the Civil War.

Delivered on 6th July, 1865.

370. Master and Servant—Report from the Select Committee.
428. Kitchen and Refreshment Rooms (House of Commons)—Report from the Select Committee.
Zollverein—Treaty of Commerce.

Patents.

From Commissioners of Patents Journal, July 14th.

Grants of Provisional Protection.

Boats and vessels, fittings for—1731—J. Cox.
Bobbin net or twist lace, production of—1757—S. Bates.
Bricks—1698—T. L. Jowett.
Carriages—1767—J. Harrington.
Carriages, drags for—1680—A. E. Dobbs.
Carriages, locomotive engines and railway—1646—G. Smith.
Carriage windows, railway and other—1718—J. K. Farnworth.
Castors—1689—R. Eastman.
Chair ladder—1232—J. B. Lavanchy.
Cheeses, table for dressing of—1722—W. Percival.
Chisels, &c., heating—1715—W. Brooks.
Circular endless railway—1771—W. E. Gedge.
Clay tobacco pipes—1683—L. White.
Coin, reception of—1675—J. M. Abrams.
Collars and cuffs—1741—R. A. Brooman.
Cotton gins—1714—J. H. Johnson.
Croquet mallets—1704—S. S. Bateson.
Dresses, linings for ladies'—1763—P. Passavant.
Eggs, desiccating—1632—C. A. Lamont.
Feeding bottle, food or fluid regulator for—1727—W. Botham.
Fire-arms, breech loading—642—F. Tolhausen.
Furnaces—1620—R. A. Brooman.
Furnace bars and fire grates—1672—S. Godfrey.
Furnaces, self-acting apparatus for distributing feeding materials in high—1733—A. Prince.
Gas retorts—1737—W. Schofield.
Gas, supplying to burners—1687—H. S. Snell and F. E. Thomas.
Gunpowder—1679—J. Gale.
Hats, &c.—1707—W. E. Newton.
Hay, straw, &c., apparatus for cutting—1712—J. Spratt.
Hydro-carbons, apparatus for burning liquid—1711—R. A. Brooman.
Knitting machines—1747—G. Davies.
Lace, folding and carding—1238—T. W. Roe.
Life-boats—1688—H. A. Bonneville.
Liquids, measuring—1674—E. K. Dutton.
Locks—1735—W. E. Newton.
Locomotive engines and in springs of railway carriages—1769—J. E. Wilson.
Magnesium for illuminating purposes—1695—J. Solomon.
Magnesium light—1696—C. R. Bamber.
Metallic tubes and rods—1749—J. Atkins.
Motive power, apparatus for generating—1656—W. Clark.
Motive power, hydraulic apparatus for producing—1701—J. E. Spanoghe.
Motive power, machine for obtaining—1468—H. Mosely.
Needles—1685—W. Lusty.
Noxious exhalations, sanitary apparatus for preventing—1690—M. A. Muir and J. McIlwham.
Ornaments—1779—H. Emanuel.
Pessary—1141—W. E. Gedge.
Pianofortes—1708—W. E. Newton.
Printing in colours—1702—R. A. Brooman.
Punching apparatus, portable—1706—J. Medhurst.
Quicksilver or mercury, amalgams of—1719—W. E. Newton.
Railways, permanent ways of—1705—J. Whittle.
Railways, points and crossings of—1751—W. McGregor.
Railways, securing the rails of—1713—J. Kirkham.
Railway trains, signalling on—1676—M. Siegrist.
Railway trains, stopping—1684—W. J. Murphy.
Railway trains, stopping and retarding—1759—J. Naveaux.
Refrigerator—1700—M. Ashby.
Rice, &c., cleaning—1777—J. W. Gray.
Riveting and making rivets, machinery for—1709—H. M. Kennard.
Rivets, bolts, spikes, &c.—1686—E. Finch.
Sash windows, apparatus for preventing opening of, from outside—1726—E. Reynolds.
Ships, steering—1496—W. A. Brown.
Shirt front—1725—W. E. Newton.
Steam boilers, furnaces, and engines—1745—E. Elliott.
Surface condensers—1677—W. E. Newton.
Table or seat, portable—1691—R. A. Brooman.
Taps or valves—1655—E. G. Brewer.
Telegraphic communications, effecting and recording—1628—M. Henry.
Telegraphy, submarine and land—1753—I. Baggs.
Tubular structures—1755—E. Deane
Twist lace machines—1723—R. Boot and J. Coxon.
Typographic and lithographic printing—1665—W. Clark.
Umbrellas and parasols—1673—N. de Becker.
Under vests—1721—J. Webster.
Vices—1761—L. H. G. Ehrhardt.
Water-closets—967—J. I. Darribet.
Weaving, looms for—1743—J. Keighley.
Woven fabrics, circular pressing machines for finishing—1717—W. Ingham.
Yarns, twisting, doubling, &c.—1644—E. Whalley.
Yarns, &c., to be woven, sizing machines for sizing—1729—D. Mercer, T. Mercer, J. Mercer, and J. Mercer.

Invention with Complete Specification Filed.

Steam and water valves—1834—N. Jenkins.

Patents Sealed.

147. W. Jeffreys.	159. A. W. Preger.
149. E. Deane.	161. E. D. Farcot.
150. S. Ballard.	166. W. C. Hicks.
151. J. W. Gregg.	189. M. Robinson.
153. J. Burch.	224. R. Mushet.
154. J. Coulter.	

From Commissioners of Patents Journal, July 18th.

Patents Sealed.

170. D. Munro and T. Wright.	294. J. Ball.
172. J. Turney, jun. & G. Wood.	300. G. and D. Hurn.
183. T. Lester.	404. W. Adams.
186. J. H. Wilson.	434. D. C. Pierce.
188. J. Snider, jun.	522. J. Howard.
191. C. Brakell, W. Hochl, and W. Gunther.	609. D., J., and J. Morris.
	619. C. F. Varley.
194. E. Atkinson.	645. A. C. Henderson.
201. M. A. Dietz.	819. R. W. Morrell.
221. G. Haseltine.	836. W. E. Newton.
250. W. E. Newton.	893. W. M. Fuller.
270. W. H. Cox.	1233. G. T. Bousfield.
281. J. and W. McNaught, jun.	

Patents on which the Stamp Duty of £50 has been Paid.

2002. C. E. and J. Green.	2065. W. E. Newton.
2007. T. Hill.	2035. T. G. Ghislin.
2077. T. Meriton.	2052. O. F. Morrill.
2042. R. Dunn.	2060. R. Barrett.
2050. W. Gossage.	

Patents on which the Stamp Duty of £100 has been paid.

1711. J. Musgrave.	1591. J. Fowler, jun.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, JULY 28, 1865. [No. 662. Vol. XIII.

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Announcements by the Council.

Prizes to Art-Workmen.

The Worshipful Company of Salters contribute £10 *annually to this Prize Fund.*

The Council of the Society of Arts hereby offer Prizes for Art-Workmanship, according to the following conditions:—

I. The works to be executed will be the property of the producers, but will be retained for exhibition, in London and elsewhere, for such length of time as the Council may think desirable.

II. The exhibitors are required to state in each case the price at which their works may be sold, or, if sold previously to exhibition, at what price they would be willing to produce a copy.

III. The awards in each class will be made, and the sums specified in each class will be paid, provided the works be considered of sufficient merit to deserve the payment; and, further, in cases of extraordinary merit additional awards will be given, accompanied with the medal of the Society.

IV. Before the award of prizes is confirmed, the candidates must be prepared to execute some piece of work sufficient to satisfy the Council of their competency.

V. *Bona-fide* Art-workmen only can receive prizes.

VI. All articles for competition must be sent in to the Society's house on or before Thursday, the 14th of December, 1865, and must be delivered free of all charges. Each work sent in competition for a Prize must be marked with the Art-workman's name, or, if preferred, with a cypher, accompanied by a sealed envelope giving the name and address of the Art-workman. With the articles, a description for insertion in the catalogue should be sent.

VII. Although great care will be taken of articles sent for exhibition, the Council will not be responsible for any accident or damage of any kind occurring at any time.

VIII. Prices may be attached to articles exhibited and sales made, and no charge will be made in respect of any such sales.

X. All the prizes are open to male and female competitors, and in addition, as regards painting in porcelain, decorative painting, and wall mosaics, a second set of prizes, of the same amounts, will be awarded among female competitors. If a female desire to compete in the female class only, she must declare her intention accordingly. The originals of the works prescribed may be seen at the South Kensington Museum, in the gallery at the entrance of the Sheepshanks pictures.

Casts may be seen at the Society of Arts, Adelphi, London, and the Schools of Art at Edinburgh, Dublin, Manchester, Glasgow, Birmingham, and Hanley in the Potteries.

Photographs, chromolithographs, engravings, rough casts in metal, &c., may be purchased at the Society of Arts, John-street, Adelphi, at the prices named.

The plaster casts may be obtained from Mr. D. Brucciani, 39, Russell-street, Covent-garden, W.C.

*** The Council are happy to announce that several of the works which received first prizes in the competitions of 1863, 1864, and 1865 have been purchased by the Department of Science and Art, to be exhibited in the South Kensington Museum and the Art Schools in the United Kingdom.

FIRST DIVISION.

Works to be Executed from Prescribed Designs.

For the successful rendering of the undermentioned designs in the various modes of workmanship according to the directions given in each case.

Class 1.—Carving in Marble, Stone, or Wood.

(*a.*) *The Human Figure.*—One prize of £15 for the best, and a second prize of £7 10s. for the next best, work executed in marble or stone, after the Boy and Dolphin cast from a chimney-piece, ascribed to *Donatello*. Original in the South Kensington Museum, No. 5,896. Dimensions to be one-eighth less than the cast (linear).—This design may be adhered to strictly or adapted to any architectural purpose.

[Cast—Fifteen Shillings; Photograph—One Shilling.]

(*b.*) *Ornament.*—One prize of £10 for the best, and a second prize of £5 for the next best work, executed in marble, stone, or wood after a carved chair-back in the South Kensington Museum. Dimensions to be two-thirds of the cast (linear).

[Cast—Twelve Shillings. Photograph—One Shilling.]

(*c.*) *Ornament.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed in stone, after a *Gothic bracket* in the Architectural Museum. Dimensions the same as the cast. In this design the details may be improved by the introduction of small animals, and the human head may be changed according to the taste of the art-workman.

[Cast—Ten Shillings; Photograph—One Shilling.]

(*d.*)—One prize of £20 for the best, and a second prize

of £10 for the next best, work carved in *wood* after a design by *Holbein*, as an *Inkstand* or *Watch-Holder* on three feet. Dimensions optional.

[Wood Engraving—Sixpence.]

(*e.*)—One prize of £15 for the best, and a second prize of £7 10s. for the next best, work carved in wood after the *Head of a Harp* of the period of Louis XVI., in the South Kensington Museum, No. 8,531. The head and bust only need be fully completed. Dimensions the same as the cast.

[Cast—Thirty Shillings; Photograph—One Shilling.]

(*f.*) *Ornament.*—One prize of £10 for the best, and a second prize of £5 for the next best, work carved in wood after an *Italian picture frame* in the possession of Henry Vaughan, Esq. Dimensions optional.—This design may be adhered to strictly or adapted in such manner as the workman may think fit.

[Photograph—Two Shillings.]

(*g.*) *Ornament carved and gilt.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed in wood, carved and gilt after a *Console Table* in the South Kensington Museum, No. 6947, of the period of Louis XVI. The work to be carved roughly in wood, then to be prepared in the white by a gilder, then cut up or carved in the white by the carver, then to be gilt in mat and burnished gold. As such work may probably be executed by two persons, the prize will be apportioned as the judges may determine.

[Photograph—One Shilling.]

Class 2.—Repoussé Work in any Metal.

(*a.*) *The Human Figure as a bas-relief.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Raphael's* "*Three Graces.*" Dimensions—The figures to be six inches high.

[Photograph—One Shilling.]

(*b.*) *Ornament.*—One prize of £5 for the best, and a second prize of £3 for the next best, work executed after a Tazza in silver, date 1683, the property of Sir W. C. Trevelyan, Bart., now in the South Kensington Museum. Dimensions—The same as the model.

[Photograph—One Shilling.]

Class 3.—Hammered Work, in Iron, Brass, or Copper.

Ornament.—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work executed after the portion shown in the photograph of the Pediment of a Gate (German work, date about 1700) in the South Kensington Museum, No. 5,979. To be adapted for use as a bracket. Dimensions—Twelve inches deep.

[Photograph—One Shilling and Threepence.]

Class 4.—Carving in Ivory.

(*a.*) *Human Figure in the round.*—One prize of £15 for the best, and a second prize of £10 for the next best, work executed after a miniature statuette (Italian), No. 304 in the South Kensington Museum; dimensions—the same as the cast; or after a medallion portrait of Flaxman, by himself, No. 294 in the South Kensington Museum; dimensions—to be reduced in height by one-half (linear).

[Cast of Statuette and Photograph of Medallion—One Shilling each.]

(*b.*) *Ornament.*—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work executed after a pair of *Tablets*, in the possession of John Webb, Esq. Dimensions—The same as the cast.

[Cast—One Shilling.]

Class 5.—Chasing in Bronze.

(*a.*) *The Human Figure.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after a reduced copy of "*Clytié.*" A rough casting in bronze, on which the chasing must be executed, will be supplied by the Society at cost price—£2 10s.

[Plaster Cast—Three Shillings and Sixpence.]

(*b.*) *Ornament.*—One prize of £10 for the best, and a second prize of £7 10s. for the next best, work executed after *Goutier*, from a cabinet in the possession of Her Majesty the Queen. A rough casting in bronze, on which the chasing must be executed, will be supplied by the Society at cost price—3s. 6d.

[Plaster Cast—One Shilling.]

Class 6.—Etching and Engraving on Metal—Niello Work.

Ornament.—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after arabesques by Lucas Van Leyden, A.D. 1528. No. 18,968 in the South Kensington Museum. To be engraved the height of the photograph, and, if round a cup or goblet, repeated so as to be not less than nine inches in length when stretched out.

[Photograph—Sixpence.]

Class 7.—Enamel Painting on Copper or Gold.

(*a.*) *The Human Figure.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Raphael's design of the* "*Three Graces,*" executed in *grisaille*. Dimensions—The figures to be four inches high.

[Photograph—One Shilling.]

(*b.*) *Ornament.*—One prize of £5 for the best, and a second prize of £3 for the next best, work executed after a German arabesque (16th century). No. 19,003 in the South Kensington Museum. Dimensions—The same as the Photograph.

[Photograph—Sixpence.]

Class 8.—Painting on Porcelain.

(*a.*) *The Human Figure.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Raphael's* "*Two Children,*" in the cartoon of "*Lystra.*" Dimensions—the same as the Photograph. This work is to be coloured according to the taste of the painter.

[Photograph—Ninepence.]

(*b.*) *Ornament.*—One prize of £5 for the best, and a second prize of £3 for the next best, work executed after arabesques by Lucas Van Leyden, 1528, No. 18,968 in the South Kensington Museum, and coloured according to the taste of the painter. Dimensions—Double the size of the Photograph (linear).

[Photograph—Sixpence.]

N.B.—A second set of prizes of the same amount is offered to female competitors. See conditions, Section IX.

Class 9.—Decorative Painting.

(*a.*) *Ornament.*—One prize of £5, and a second prize of £3, for a work, executed after an *ornament*, from *Castel R. Pandino*, near Lodi, from a drawing in the South Ken-

sington Museum, No. 1,150. Dimensions—length 4ft.—width, enlarged from the print in the same proportion.

[Coloured Print—One Shilling.]

(*b.*) *Ornament.*—One prize of £5, and a second prize of £3, for a work, executed after a *picture frame*, in the South Kensington Museum, No. 7,820. Dimensions—5 feet by 3 feet 11½ inches, outside measure. The works to be executed on canvass, either with or without stretchers, in cool colours. Some lines of the mouldings may be gilt.

[Photograph—One Shilling and Sixpence.]

N.B.—A second set of prizes of the same amount is offered to female competitors. See conditions, Section IX.

Class 10.—Inlays in Wood (Marquetry, or Buhl), Ivory or Metal.

Ornament.—One prize of £5 for the best, and a second prize of £3 for the next best, work executed after a specimen in the possession of the Hon. John Ashley. Dimensions—one-third larger than the Lithograph (linear).

[Outline Lithograph—Sixpence.]

Class 11.—Cameo Cutting.

(*a.*) *Human Head.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Wyon's* heads of the Queen and Prince Consort, on the Juror's medal of 1851.

(*b.*) *Animal.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after *Wyon's* "*St. George and the Dragon,*" on the Prince Consort's medal. Dimensions the same as the casts.

[Casts—Sixpence each.]

Class 12.—Engraving on Glass.

Ornament.—One prize of £10 for the best, and a second prize of £3 for the next best, work executed after arabesques by Lucas Van Leyden, A.D. 1528. No. 18,968 in the South Kensington Museum. To be engraved the height of the engraving; and if round a glass or goblet, repeated so as not to be less than 9 inches long when stretched out.

[Photograph—Sixpence.]

Class 13.—Wall Mosaics.

Human Head.—One prize of 10 for the best, and a second prize of £7 10s. for the next best, work executed after *Bertini*, of Milan. A preparatory drawing must be made, coloured, after the lithograph, on which the lines and disposition of the tesseræ must be marked. The dimensions of the work should be regulated by the size of the tesseræ proposed to be used, which size may be left to the choice of the artist. Although desirable, it is not necessary to execute the whole subject in actual mosaic, but if a part only be done, the eye must be in such portion. A coloured drawing, with tesseræ, may be seen at the Society's house, and in the South Kensington Museum, and tesseræ of two sizes may be obtained from Messrs. Minton, Stoke-upon-Trent, Messrs. Maw and Co., Brosely, Shropshire, Messrs. Powell and Sons, Temple-street, Whitefriars, and Messrs. Jesse Rust and Co., Carlisle-street, Lambeth.

[Lithographic Outline Coloured—Two Shillings.]

N.B.—A second set of prizes of the same amount is offered to female competitors. See conditions, Section IX.

Class 14.—Gem Engraving.

(*a.*) *Human Head.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after a cameo portrait of Savonarola, No. 7,541 in the South Kensington Museum. Dimensions—the same as the cast.

[Cast—Sixpence.]

(*b.*) *Full-length figure.*—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after a small Wedgwood medallion, No. 5,827 in the South Kensington Museum. Dimensions—the same as the cast.

[Cast—Sixpence.]

Class 15.—Die Sinking.

Human Head.—One prize of £10 for the best, and a second prize of £5 for the next best, work executed after the head of the Prince Consort, by *Wyon*, on the Society's medal. Dimensions—half the size of the original (linear).

[White metal example—Sixpence.]

Class 16.—Glass Blowing.

Ornament.—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work executed after an original in the South Kensington Museum, No. 1,813. Dimensions—as given in the wood engraving.

[Engraving—Sixpence.]

Class 17.—Bookbinding and Leather Work.

(*a.*) *Bookbinding.*—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work executed in bookbinding, after an Italian specimen in the South Kensington Museum, No. 7,925. The work to be bound should be some classical author of the size given. Dimensions—the same as the photograph.

[Photograph—One Shilling.]

(*b.*) *Leatherwork.*—One prize of £7 10s. for the best, and a second prize of £5 for the next best, work of boiled and cut leatherwork for the outside covering of a jewel casket. Original in the South Kensington Museum, No. 7,768. Dimensions—one-half larger than the photograph (linear).

[Photograph—One Shilling.]

Class 18.—Embroidery.

Ornament.—One prize of £5 for the best, and a second prize of £3 for the next best, work executed, either after a German example in the Green Vaults at Dresden, or an Italian Silk in the South Kensington Museum, No. 7,468, which may be adapted to a screen. Dimensions—according to the taste of the embroiderer.

[Photograph—German, Sixpence; Italian, One Shilling.]

Class 19.—Illuminations.

Ornament.—One prize of £5 for the best, and a second prize of £3 for the next best, copy made from an Altar Card, attributed to Giulio Clovio, in the South Kensington Museum, No. 2,958, or from a MS. border, date 1450, No. 3,057, in the South Kensington Museum. Dimensions—one-half larger than the Photograph (linear).

[Photograph—Two Shillings.]

SECOND DIVISION.

Works to be Executed without Prescribed Designs.

Class 20.—Modelling.

The Worshipful Company of Plasterers, London, offer the following:—

Ornament.—One prize of £10 for the best, and a second prize of £5 for the next best, floriated bracket or truss in

the Italian Renaissance style—dimensions, 14 inches on the beam, 12 inches on the wall, and 8 inches on the face—to be designed and modelled by the competitor, or the designer and modeller may co-operate in the production, when the prize will be divided between them.

Artizans' apprentices and students may compete for these prizes, but not master tradesmen, masters in Schools of Art, or those training for masters in the Central School of the Department of Science and Art.

Class 21.—Wood Carving.

(*a.*) *Human figure in the round, in alto or in bas relief. Animals or natural foliage may be used as accessories.* 1st prize of £25 and the Society's Silver Medal. 2nd prize of £15. 3rd prize of £10.

(*b.*) *Animal or still-life. Fruit, flowers, or natural foliage may be used as accessories.* 1st prize of £10. 2nd prize of £7 10s. 3rd prize of £5.

(*c.*) *Natural foliage, fruit, or flowers, or conventional ornament, in which grotesque figures or animals may form accessories, preference being given where the work is of an applied character for ordinary decorative purposes, as representing commercial value.* 1st prize of £10. 2nd prize of £7 10s. 3rd prize of £5.

(By Order)

P. LE NEVE FOSTER, *Secretary.*

Proceedings of the Society.

Musical Education Committee.

The following is a copy of the Charter granted in 1830 to the Royal Academy of Music :—

George the Fourth, by the Grace of God, of the United Kingdom of Great Britain and Ireland King, Defender of the Faith,—to all to whom these presents shall come greeting. Whereas our right trusty and right entirely beloved councillor, Edward Venables, Archbishop of York, Primate of England and Metropolitan; our Lord Almoner; our right trusty and right entirely beloved cousin and councillor, Arthur Duke of Wellington; our right trusty and well beloved councillors, John Fane, commonly called Lord Burghersh, and Sir John Leach, Knight, Vice-Chancellor of England, and others of our loving subjects, have, under our royal patronage, formed themselves into a Society or Institution to promote the cultivation of the science of music, and to afford facilities for attaining perfection in it, by assisting with general instruction all persons desirous of acquiring a knowledge thereof; and having subscribed and collected considerable sums of money for that purpose, have humbly besought us to grant unto them and unto such other persons who are now, or who shall hereafter become, members of the said Society, our royal charter of incorporation for the purposes aforesaid.

Now know ye that we, being desirous to promote such object, have, of our special grace, certain knowledge, and mere motion, given and granted; and we do by these presents, for us, our heirs, and successors, give and grant that the said Edward Venables, Archbishop of York, Arthur Duke of Wellington, John Fane, commonly called Lord Burghersh, and Sir John Leach, and such others of our loving subjects as have formed themselves into, and are now members of, the said Society, or who shall at any time hereafter become members thereof, according to such bye-laws or regulations as shall be hereafter framed or enacted, and their successors be, and shall for ever hereafter continue and be, by virtue of these presents, one body politic and corporate, by the name of the "Royal Academy of Music;" and them and their successors, for the purposes aforesaid, we do hereby constitute and declare to be one body politic and corporate, and by the same name to have perpetual succession, and for ever hereafter to be persons able and capable in the law, and have power to purchase, receive, and possess, any goods and chattels whatsoever, and (notwithstanding the statutes of mortmain) to purchase, hold, and enjoy, to them and their successors, any lands, tenements, and hereditaments, whatsoever, not exceeding, at the time or times of purchasing such lands, tenements, and hereditaments, respectively, the yearly value, at a rack-rent, of one thousand pounds in the whole, without incurring the penalties or forfeitures of the statutes of mortmain, or any of them; and by the name aforesaid to sue and be sued, plead and be impleaded, answer and be answered unto, defend and be defended, in all courts and places whatsoever, of us, our heirs and successors, in all actions, suits, causes, and things, whatsoever, and to act and do, in all things relating to the said corporation, in as ample manner and form as any other our liege subjects being able and capable in the law, or any other body politic or corporate, in our said United Kingdom of Great Britain and Ireland, may or can act or do; and also to have and to use a common seal, and the same to alter, vary, break, and renew, as they shall from time to time think fit.

And we do hereby declare and grant that the number of members of the said body politic and corporate shall be indefinite, and that for the better rule and government of the said body politic and corporate, and for the better direction, management, and execution, of the business and concerns thereof, there shall be, from the date of these presents thenceforth and for ever, a Board of Directors, Committee of Management, and treasurer of the said body politic and corporate; and that such Board of Directors shall consist of thirty members, to be elected or appointed from among the members of the said body politic and corporate, one of which thirty members shall be President, and four shall be Vice-Presidents of the said body politic and corporate, and that any four of the Directors, if either the President or one of the Vice-Presidents shall be one of that number, or any five of the Directors, if the President or one of the Vice-Presidents shall not be one of that number, shall be a quorum. And we do hereby nominate and appoint that the said Edward Venables, Archbishop of York, Arthur Duke of Wellington, John Fane, commonly called Lord Burghersh, and Sir John Leach, and such other twenty-six members of the said body politic and corporate as they, the said Edward Venables, Archbishop of York, Arthur Duke of Wellington, John Fane, commonly called Lord Burghersh, and Sir John Leach, or any two of them, shall appoint, shall be the first Board of Directors, and that the first President and the first Vice-Presidents of the said Society shall be likewise appointed by the said Edward Venables, Archbishop of York, Arthur Duke of Wellington, John Fane, commonly called Lord Burghersh, and Sir John Leach, or any two of them, out of such of the members of the said Society as shall have been previously named Directors; and that any President, Vice-President, or Director, shall have full power to resign and vacate his office by giving to the Board of Directors one calendar month's previous notice of his intention so to do.

And that the Board of Directors shall have the power of convening a general meeting of the members of the said Society whenever they may deem it expedient. And we do further declare and grant that the Board of Directors shall have the power to make such rules, orders, and bye-laws, as they shall deem useful and necessary for the regulation and management of the said body politic and corporate, and of the estates, goods, and business thereof, and for fixing and determining the manner of electing the future President, Vice-Presidents, Directors, and Committee of Management, and the Chairman thereof, and the period of their continuance in

office respectively, and also for fixing and determining the hours and places of holding any general meetings of the said body politic and corporate, and for the admission of members, and the privileges to be conferred upon them, and the classes to which they may respectively be appointed to belong, and the annual or other sum or sums of money to be paid by the members of the said body politic and corporate, whether upon admission or otherwise, towards carrying on the purposes of the said body politic and corporate; and such rules, orders, and bye-laws, from time to time to vary, alter, or repeal, and to make such new or other rules, orders, and bye-laws, as they shall think most useful and expedient, so that the same be not repugnant to these presents, or to the laws of this our realm.

And for the further rule and government of the said body politic and corporate, and for the further and better direction, management, and execution, of the business and concerns thereof, we do further declare and grant that there shall be a Committee of Management, which shall consist of not more than fifteen, nor less than seven, members, to be elected from among the members of the said body politic and corporate. And we do hereby nominate and appoint that the said John Fane, commonly called Lord Burghersh, and such other members of the said body politic and corporate, not being more than fifteen, nor less than seven, other members, including the said John Fane, commonly called Lord Burghersh, as the said Court of Directors shall appoint, shall be the first Committee of Management, the said John Fane, commonly called Lord Burghersh, to be the first Chairman. And it is our further will and pleasure that the said John Fane, commonly called Lord Burghersh, shall be and continue Chairman of the Committee of Management for and during the term of his natural life, or until he shall resign; and that every future chairman shall continue in office for such time as shall be declared in the bye-laws or regulations of the said body politic and corporate hereafter to be enacted. And that in case and so often as the said John Fane, commonly called Lord Burghersh, shall, at any time during his continuance in office, be absent from England, the Committee of Management shall elect from amongst the members of the Committee a person to be Chairman of the said Committee during the absence of the said John Fane, commonly called Lord Burghersh, and no longer. And it is our further will and pleasure that any member of the Commitee shall have full power to resign and vacate his office by giving to the Board of Directors one calendar month's previous notice of his intention so to do; and that the Committee of Management shall nominate and appoint, out of the members of the said body politic and corporate, a fit and proper person to be treasurer of the said Society who shall continue in his office during the pleasure of the Committee, unless he shall resign or vacate the said office. And it is our further will and pleasure that no business shall be transacted at any meeting of the Committee unless three members of the Committee shall be present; and that at the Committee of Management the person in the chair shall, in addition to his privilege of voting with the other members of the Committee, have a second or casting-vote on all questions where the votes shall happen to be equal. And it is our further will and pleasure that the Committee of Management shall have the whole and exclusive direction, management, and superintendence of the students, and of the Academy for the education of the students; and also shall have the appointment and removal of the principal musical professor, and of all the other musical professors, and of all the music and other masters, and the subordinate officers and servants of the Society, and shall define and regulate their respective duties, and fix and pay out of the funds of the Society their respective salaries, and shall also have, in every other respect, the entire management and regulation of the expenditure of the Society; and shall also have full power to draw on the treasurer for such monies as they shall require for the purposes of the Society, and shall also have full power to propose to the Board of Directors such additions to, and alterations in, the rules, orders, bye-laws, and regulations of the said body politic and corporate as they shall think proper; and also shall have full power to appoint such persons, being musical professors resident in England, or officers of any foreign musical institution, to be honorary members of the said body politic and corporate, as they shall deem expedient, every such appointment being in writing, and signed by the Chairman of the Commitee. And it is our further will and pleasure that the Committee of Management, at a meeting to be especially called for that purpose, of which due notice shall be given, shall have full power to remove from the said body politic and corporate any member or honorary member of the same, such member or honorary member having been first duly summoned to attend such meeting; but no member or honorary member of the said body politic and corporate shall be removed except by the votes of two-thirds of the members of the Committee. And it is our further will and pleasure that on a certain day, to be fixed by the Board of Directors, in the month of March in every year, the Committee shall lay before the Board of Directors an account of the receipts and expenditure of the Society for the preceding year, and that account shall be audited by two auditors, to be appointed by the Board of Directors from amongst the Directors. And it is our further will and pleasure that all orders and directions to the professors, masters, and subordinate officers and servants of the Society, which shall have been made and determined upon by the Committee of Management for the promotion of the objects of the Society, shall be given and delivered by or through the Chairman of the said Committee; and all the professors, masters, and other subordinate officers and servants of the Society, are hereby required punctually to obey and observe, in the execution of the duties of their respective offices, all the orders and directions which shall be so given and delivered to them by or through the Chairman of the Committee of Management. And it is our further will and pleasure that the Chairman of the Committee of Management shall have full power to call, at any time, an extraordinary meeting of the Board of Directors, and also a meeting of the Committee of Management, whenever he shall deem it expedient. In witness whereof we have caused these our letters to be made patent. Witness ourself, at our Palace of Westminster, this twenty-third day of June, in the eleventh year of our reign.

By writ of the Privy Seal. Scott.

The following dimensions of the principal rooms at the Royal Academy of Music have been kindly supplied by Mr. Lucas:—

Governesses Room—21ft. 7in. by 15ft. 4in.; height, 15ft.

Concert Room—71ft. 8in. by 28ft.; height, 15ft.

Letter K.—26ft. 6in. by 28ft.; height, 11ft.

Letter I.—21ft. 7in. by 15ft. 4in.; height, 11ft.

Letter J.—21ft. by 14ft. 4in.; height, 11ft. Recess—6ft. 3in. by 9ft. 8in.

Committee Room—18ft. 6in. by 14ft. 3in.; height, 15ft.

Letter B.—17ft. 11in. by 10ft. 3in.; height, 10ft. 8in.

Letter C.—22ft. 4in. by 10ft. 8in. and 9ft. 6in; height, 10ft. 6in.

Letter A. (Gentlemen's Waiting Room)—19ft. by 14ft. 7in.; height, 10ft. 6in.

Letter G.—22ft. 7in. by 9ft. 6in.; height, 7ft. 11in.

Secretary's Office—23ft. by 11ft. 10in. and 17ft.; height, 14ft.

Library—20ft. by 19ft. 6in.; height, 10ft.

Letter D.—15ft. 1in. by 11ft. 9in.; height, 8ft. 1in.

Ladies' Waiting Room—23ft. by 11ft. 10in. and 17ft.; height, 15ft.

Besides the above, there are sleeping rooms for the Governess and servants, also offices, &c.

ON THE IMPERIAL CONSERVATOIRE OF PARIS AND THE ROYAL ACADEMY OF MUSIC, LONDON.

By Manuel Garcia.

In comparing the Imperial Conservatoire of Paris with the Royal Academy of Music in London, we are forced to observe that the former has two immense advantages in its favour:—It is entirely supported by the State; its course of study is distinctive and complete. Hence arises a radical difference between the two schools, both as to their appliances and results.

The Conservatoire, as a national institution, has been allotted a suitable locality, which includes in its area various halls, class-rooms, and three theatres. Two of the latter are exclusively devoted to the use of the dramatic pupils and those who propose qualifying themselves for the lyric stage. The third and largest theatre is used for the public competitors, and is the well-known hall of the Conservatoire where operas are performed. Endowed with the necessary funds, the Conservatoire bestows a gratuitous education on nearly 600 pupils, besides presenting annually a purse with £40 to each of its ten most gifted students. All those pupils who are crowned in the public competition receive a prize worth £12.

Formerly boarders of both sexes were accommodated in the Conservatoire, but it is now thought advisable to admit only non-residents. Three times a year the pupils are subjected to an examination before a jury, and those who are not considered sufficiently promising are dismissed. At the same time a summons is sent through all France to supply the vacancies, and the influx of candidates is so great that frequently three hundred are examined at once, thus rendering it easy to make good selections.

Each candidate is obliged to read tolerably a piece of music at sight and sing something he has studied. This trial serves to prove whether he possesses a good voice, correct ear, and musical feeling. Besides these qualifications the pupil must be pleasing in appearance, and not more than twenty years old.

The English Royal Academy is a private institution, always uncertain of its future, and deriving its chief sources of income from the pupils, who pay the somewhat onerous sum of thirty-five guineas annually, besides an entrance fee of five guineas. This amount being much too large for the poorer classes (from which the pupils are almost exclusively drawn), it so reduces the number of aspirants that in its best days the Academy has never contained more than 120 pupils, and at the present moment can count but 72. Most of the scholars, eager to remove such a burden of expense from their families, curtail as much as possible the duration of their studies, and leave as soon as their talents, however incomplete, can be rendered in any measure available as a means of livelihood.

To the above-mentioned chief source of income may be added the voluntary subscriptions, which have greatly diminished since the death of Lord Westmoreland; next the proceeds of a concert, and lastly a grant of £500 recently obtained from parliament.

For its scholarships the Academy is obliged to depend entirely on private donations. Such are—

The King's Scholarship	35	guineas.
Lord Westmoreland's	10	,,
Mr. Porter's	12	,,
Total	57	,,

The net income derived from all these sources is large enough to cover the ordinary expenses of the establishment, but will not suffice for the least additional outlay. For instance, everyone remarks the awkwardness displayed on the boards by young debutants from the London school, and the natural remedy would be to prepare them properly in a theatre; but for want of funds a courtyard, which formed part of the premises of the Academy, and which might have been easily converted into a theatre, has been given up in order to decrease the rent. For a similar reason the Academy is forced to a certain degree of laxity in the choice of candidates, accepting nearly all those who present themselves, without much regard to age or aptitude. What success can possibly be hoped for under such conditions?

We proceed now to an examination of the studies.

The Conservatoire forms, at the same time:—Composers, singers, instrumentalists for orchestra, pianistes, organists, comedians, and tragedians.

The studies are superintended by a director and 73 professors, the management of the establishment devolving exclusively on the director. At the time I belonged to this staff of professors, it comprised

Masters for composition.
16 ,, for solfeggi.
7 singing masters.
Masters for deportment.
,, for declamation.
,, for various instruments.

The pupils who make singing their principal study (the only class with which I propose occupying myself in this paper) if unable to read music with facility, are sent into one of the 16 classes for Solfeggi, and there receive elementary instruction. They are then removed into a singing class, where they remain two or three years, and undergo during that period several examinations. The places left vacant by departing or dismissed pupils are appropriated to the new comers, and if there are more accepted candidates than can be located they are admitted as listeners while waiting for a vacancy.

When the pupil is sufficiently advanced he joins to the study of singing that of deportment—superintended by a ballet-master, who teaches him to walk and move gracefully, also to express in action all possible situations and emotions. The declamation class then follows, in which the pupil recites the parts he has learnt by heart. These successive exercises habituate him so completely to the stage that at his first appearance he presents himself to the public with the ease and confidence of an accomplished actor.

Besides all this a student of merit has commonly before quitting the Conservatoire to pass through the trying ordeal of a public competition, both as to singing and taking parts in an opera. One meeting is held for the singers alone, and at this a first and second prize are awarded.

The jury always consists of ten or twelve musicians of eminence, who are all, with the exception of the director, strangers to the Conservatoire. Their judgment is therefore disinterested, and a powerful recommendation to the pupil who is crowned. He who on such an occasion obtains the first prize both for singing and declamation has a right to three débuts at the Opéra Comique. The public competitions terminate with the performance of an opera. In these representations the holders of first prizes figure, and it is not unusual to find, on quitting the stage, the manager of some theatre awaiting them with the offer of an engagement.

If from an examination of the French Conservatoire we pass to that of the English Academy, we find that nearly all the advantages of the former are wanting to the latter.

In the first place, at the Academy, Solfeggi are not studied, to the serious detriment of progress in its early stages, and, finally, of thoroughness in the acquirements of the artist. It is true that at the Academy there is a class for reading at sight, but in it the notes are not named,

and still less do the pupils sol-fa* in the seventh class; secondly, there is no class for deportment; thirdly, the studies do not last long enough, as the pupils are bent upon stopping as soon as possible the expenses of their education. The public concerts given by the Academy are wanting in importance, because they give rise to no public decision, and because musical celebrities are not appealed to, or in any way interested in them. Lastly, they end in nothing, and are of no material benefit to the pupil.

From all these facts I draw the inevitable conclusion that a self-supporting Royal Academy of Music is a failure. For an establishment of this kind to be able to compete with the Paris Conservatoire it must have a larger area, and at least one theatre placed at its disposal. It must have funds enough to offer a free education to some hundreds of students, and by thus addressing itself to the masses it might meet with some highly gifted natures, by whose influence, after severe and solid preparation, the tone of the English theatres might be raised, and national art finally issue from that state of subservience to foreign talent from which it has so long suffered, though not unjustly. Such an object is well worth the expenditure of some thousands per annum.

In France music and painting are placed on the same footing, each receiving aid and protection from government. In England, painting alone is thus recognised and favoured, perhaps because this Art is useful in some branches of industry.

Putting aside all consideration of the pure and ennobling enjoyments music affords to man (I say pure, because it is the most chaste and spiritual of all the arts), has it not likewise a real value as an object of commercial enterprise? Does not the impetus which it gives to trade through theatres, concerts, festivals, instrument making, engraving and printing, instruction in all branches of the science, &c., bestow the means of subsistence on thousands of families? Not being furnished with the necessary documents, I cannot here establish the relative mercantile importance of the two arts, but that of music seems to me amply entitled to the same share of encouragement as is bestowed upon painting by the English government.

The military music of France does not depend upon the Conservatoire, being taught in the military gymnasium. Here are formed bandmasters and instrumentalists. M. Coraffa, a Member of the Institute, and many years at the head of this school, could, with the present director, give much valuable information on the subject.

Proceedings of Institutions.

Thirsk Mechanics' Institute.—The twentieth annual report for last year congratulates the members on the continued progress of the Institution. It has been one of the most prosperous years since its establishment. The reading-room continues to be well attended. The library, which contains more than 1,000 volumes, 49 of which have been added during the year, has been extensively used, and the issue of the books has been 3,172. The large circulation necessitates a considerable expenditure for rebinding, replacing worn out volumes, and providing a supply of the new literature of the day. The committee regret that so small a sum remains for these purposes. The committee regret that Mr. Scott, the secretary, was compelled, by unavoidable circumstances, to resign a situation he had filled with credit to himself and great advantage to the Institute. The number of members for the past and two preceding years is as follows:—For 1862, 164; for 1863, 159; for 1864, 168. The chess and draught class continues to meet on Tuesday and Friday evenings, and affords recreation to a respectable and orderly class of members. The examination scheme of the Society of Arts was introduced here in 1862, and has been most successful. At first comparatively few candidates presented themselves, but the number has largely increased. Of the prizes offered by the Leeds Educational Board, the 1st and 2nd boys, the 1st girl, and three others came to Thirsk. The great success of the Thirsk candidates has raised this Institution to a higher position among the Yorkshire Institutions than it ever before obtained. Various local prizes are being offered to successful candidates. The balance-sheet shows that the finances of the Institute are in a favourable condition; the receipts were £86 3s. 2d., and there was a balance in hand of £11 8s. 1d.

EXAMINATION PAPERS, 1865.

(*Continued from page* 576.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

MINING AND METALLURGY.

THREE HOURS ALLOWED.

1. Describe the apparatus most commonly employed for the treatment of auriferous quartz.
2. Which is the principal ore of antimony, and how is metallic antimony commercially obtained from it?
3. How is coke manufactured from small coal, and what are the conditions necessary for the production of coke of good quality?
4. Name the principal varieties of ironstone employed in the United Kingdom, and state from what sources they are severally obtained.
5. How does black oxide of manganese usually occur, and for what purposes is it chiefly employed?
6. Describe in outline the metallurgical treatment of the copper-shales of Mansfeldt.
7. How would you estimate by assay the amount of lead and silver contained in a sample of ordinary lead ore?
8. Sketch and describe the stove generally employed for heating the blast of iron-furnaces.
9. Describe the crushing-mill made use of in Cornwall for the preparation of copper ores.
10. What are the essential characteristics of a good fire-clay?
11. What is Kaolin, where is it found, and how is it prepared for market?
12. Name the various ores of zinc, and state their everal compositions.

BOTANY.

THREE HOURS ALLOWED.

The Candidate is expected to answer correctly three questions in Section I. and six questions in Section II., including descriptions of at least two of the fresh specimens. Nos. 8, 9, and 10 each stand for an answer.

SECTION I.—VEGETABLE PHYSIOLOGY.

1. Describe the structure and function of *roots.*
2. Upon what structural and physiological conditions does the success of a *graft* depend?
3. What are *hybrids?* What are their characteristic peculiarities?
4. Describe the structure and function of *pollen.* Name three British genera, belonging to different natural orders, n which its structure is very exceptional.

* To sol-fa consists in naming the notes and beating time while singing them. It also implies transposition in the seventh class. The neglect of this first study is such in England that those who have made music their pursuit for years may still be ignorant of the number of beats in a bar of six-eighths or twelve-eighths time. Scarcely any one is familiar with more than the treble and bass clefs, and therefore few can transpose with facility. In this respect the instrumentalists are superior to the singers, as every second violin of an orchestra can read and transpose at sight.

5. What organs are frequently specially modified in *climbing* plants.

6. Describe the probable course of the *ascending* and *descending sap* in an apple-tree.

Section II.—Practical Botany.

1. Name six *fruits* commonly cultivated in Britain, which are free from adhesion (*superior*), and six which are adherent (*inferior*), indicating which are *apocarpous* and which *syncarpous*.

2. Describe the principal modifications of the fruit in British genera of *Cruciferæ*.

3. Give the principal distinguishing characters of the four *cereals* most largely grown in Britain.

4. Describe the structure of the flower and fruit of the (1) *Chestnut* and (2) *Horse-Chestnut*.

5. What is meant by the term *anatropous?*

6. Distinguish *Gramineæ* from *Cyperaceæ*.

7. Name the *natural order* to which the plants marked A, B, and C, respectively belong, with *reasons* for your opinion.

8, 9, and 10. Describe the three plants marked A, B, and C, in the proper sequence of their organs, and in accordance with the examples given in Lindley's "Descriptive Botany" and Oliver's "Lessons" (Appendix).

AGRICULTURE.

THREE HOURS ALLOWED.

I.

1. What are the principal means at our command for the improvement of light and heavy soils respectively?

2. State the practice and theory of the application of lime to the land—the uses it is believed to serve in the soil—the several modes (including quantities and times) of applying it—the results which are expected from its application.

3. State the purposes served by the plough, the harrow, the roller, and the grubber or cultivator upon the farm.

II.

4. Give a detailed account of the cultivation of the wheat crop after clover and beans respectively; and describe half-a dozen good sorts.

5. Enumerate the operations, from the previous corn stubble to the folding of sheep upon the crop, included in the cultivation of the turnip crop; and state the probable cost of each.

6. State the proper application (as regards quantity, time of year, and crop) of farm-yard manure, and of such artificial and imported manures as you may think it necessary to bring on a 400-acre farm of light soil cultivated on the four-field rotation of crops.

III.

7. What is the annual cost of working a pair of horses on a farm? specifying quantities and cost of food, wages of man, blacksmith's bill, and the other charges which enter into the account.

8. Describe the year's management of a breeding flock month by month.

9. How much turnips, mangold wurzel, hay, straw, and bought food (oil cake, meal, &c.) will a score of oxen, costing, say £18 a piece, brought home on October 1, in a fit condition to fatten during winter, have consumed by March 1, and what should they then be worth?

ANIMAL PHYSIOLOGY.

THREE HOURS ALLOWED.

1. Describe the general structure of a long bone, supposed to be recently taken from the living body. Then give an account of the microscopic characters of the osseous tissue, especially noticing any structural arrangements which appear adapted to serve in the nutrition of the bone.

2. Give an outline of the physiological uses of the blood, and mention the constituent parts of that fluid which are concerned in each chief office.

3. What is meant by the "pancreas," where is it situated, what is its purpose or use in the living animal economy, and in what manner does it accomplish that purpose?

4. Give the composition of the atmosphere, including its proper and adventitious constituents. How and to what extent is it rendered unfit for breathing by a succession of human respirations? What other impurities, mechanical or chemical, may also contaminate it, in houses, workshops, factories, or ships?

5. Describe the "external auditory passage," its length, width, direction, and mode of closure at the bottom. Also describe the "Eustachian tube," its connections and the kind of animals it exists in—What are the uses of those two parts; and how may these be interfered with?

6. Define a reflex and a sensori-motor movement; give one example of each; state the anatomical conditions necessary for their performance, and mention any uses which they serve in the animal economy.

(*To be continued.*)

PARIS EXHIBITION OF 1867.

The arrangement of an International Exhibition systematically, without separating the contributions of each nation, has been allowed to be a great desideratum. A method of realising this was sketched out in the report of the Imperial Commission for the Paris Exhibition of 1855, published in 1857; and a writer in the *Building News*, of London, proposed a plan of carrying out such an arrangement for the Universal Exhibition of 1862. The mode adopted in these cases was that of a longitudinal disposition of the classes, and a transversal one for the various countries, so that in one direction would be exhibited all the articles of the same class, while in the other might be seen all the productions of any one nation. The same principle has been adopted for the Exhibition of 1867, but with an important difference in the mode of carrying it into effect. The new building is to be oval in form, and divided into as many radii as there are classes, namely, ninety-five, as many zones as there are exhibiting nations. A visitor starting from the centre of the building, and proceeding towards the circumference, or *vice versa*, will thus be enabled to examine all the contributions of one kind and from all countries in succession; while if, on the contrary, he desire to see all the productions of any particular country, he will only have to make the tour of the zone or circle a propriated to it. This arrangement is said to be the result of a long and careful study of the subject by M. Le Play, who was Director-General of the Paris Exhibition of 1855, French and Imperial Commissioner at the London Exhibition of 1862, and is appointed Director of the Exhibition of 1867. Such an arrangement has every thing to recommend it; it will save the time of the man of business and the scientific inquirer, and will give to the whole a systematic form that will greatly enhance the value of the Exhibition in an educational point of view. There will, doubtless, be some practical difficulties to overcome; the continuity will be broken here and there by the absence of some classes of articles, and it will be necessary to allow for exuberance or poverty in others, but the principle is excellent, and it is to be hoped that nothing will prevent its being carried into practice.

M. Krantz, the chief engineer for roads and bridges in the department of the Ardèche, has been appointed to direct the works of the Exhibition.

PROPOSED EXHIBITION OF NATIONAL PORTRAITS.

On Thursday afternoon, the 13th inst., a meeting was held at the South Kensington Museum, for the purpose of promoting a National Portrait Exhibition. The Earl of

Derby presided, and amongst others present were Earl Granville, the Duke of Buccleuch, Lord Houghton, the Earl of Clarendon, Lord Taunton, Viscount Sydney, the Marquis of Lansdowne, the Dean of Windsor, Messrs. J. P. Knight, R.A., E. A. Bowring, C.B., J. Spedding, T. D. Hardy, G. Scharf, R. Redgrave, R.A., Rev. Canon Brock, Henry Cole, C.B., &c.

Lord DERBY, upon taking the chair, explained how it was that he occupied that position. The fact was that some time ago, before the Miniature Exhibition was opened, Mr. Redgrave called upon him with reference to any contribution which he might be able to offer, and in the course of conversation he (the noble lord) suggested an idea, which had occurred to him several years ago, which he thought would be of great interest, viz., an exhibition of a chronologically-arranged series of national portraits of historical characters. Mr. Redgrave adopted the suggestion, and reported the conversation to the Committee of Council on Education. That committee took the matter up, and requested him to put down the substance of the propositions which he had ventured to submit. In consequence of that he wrote a letter, extracts from which had been circulated, in which he explained the views he held. He heard nothing more of the matter until he received a printed paper, giving an extract from his letter, signifying the approval of the Committee of Council on Education; and in the list of those noblemen and gentlemen favourable, his name was inserted as president. This certainly took him by surprise, but he felt that he could not decline. They were not there for the purpose of passing any resolutions, but as a committee of advice. The object was to form a collection of portraits—probably beginning about the middle of the fifteenth century, and coming down to a very recent period. These portraits, he thought, should be arranged in chronological order. Not only would this give them a most interesting exhibition of great historical men, royal personages, statesmen, warriors, men of letters, &c., but also an opportunity of tracing the progress of British art during that period, and of studying the works of such men as Holbein, Vandyck, Lely, Kneller, Gainsborough, Romney, Lawrence, Hudson, and others. He thought that to the students of history, as well as to the general public, such an exhibition would be of the greatest possible interest. It was a question to be settled by circumstances whether the exhibition should be for two or three years. That would depend upon the number of contributions and the space at their disposal. It was very important that they should consider the best means of addressing the proprietors of the numerous portraits scattered throughout the country. Mr. Samuel Redgrave, who had been so successful with regard to the Miniature Exhibition, had kindly undertaken the necessary correspondence; and it was proposed that the exhibition should take place in the arcade which served as refreshment-rooms during the Exhibition of 1862. There were high side windows, and, having a north light, the place was not subject to an inconvenient glare. Within the last half hour Lord Granville, Mr. Cole, and himself, visited the place. On one side was a blank wall, and on the other a series of windows, divided by bays. It was proposed to have a passage on the window side, and have screens at intervals of 18 or 20 feet, so as to afford more space. There would be a side light upon all the pictures except those occupying the bottom of the bays. These would be subject to the disadvantage of having the light opposite to them. They had calculated that if they gave each picture 24 square feet of room, there would be space for 800 portraits. There would be three entrances—one in the Exhibition-road, one in the Prince Albert-road, and another from the Horticultural-gardens. It was proposed to open the exhibition in April, 1866, and of course it would depend upon the number of portraits how many exhibitions there would be. If they had three exhibitions he thought they should begin with the earliest time, and so come down to the present; if they had only two, that the first period should come down to 1688, and the second to the present time. He would recommend that the pictures should be distributed rather sparsely, and not crowded together. With regard to the promises of support, he had communications from several, and had received great encouragement. The moment the proposal took a definite form, he thought it desirable and respectful to her Majesty that she should be consulted, and that if possible they should obtain the valuable assistance of her approval and co-operation. He had therefore communicated with General Grey, who in his reply stated that her Majesty desired him to say that the proposal received her warm approval, and that she would be happy to assist in furthering the object; whatever her Majesty could do in contributing portraits from the Royal collections would be done. General Grey added that with respect to the collection at Windsor there might be some difficulty, as her Majesty resided there so much; but still it was very likely that something might be done even there. At Buckingham Palace there would be no difficulty. The letter concluded by saying that the proposal received her Majesty's best sanction. He (the noble lord) congratulated them upon this, as they could not begin under more favourable auspices. Lord Exeter had promised to do what he could; so had the Duke of Wellington.

Earl GRANVILLE considered that they were most fortunate in having Lord Derby as President, and thought they ought to thank him for his valuable suggestion.

Mr. SCHARF suggested that they should take three different classes of persons instead of the chronological order—say royal personages first, then warriors, &c., and, thirdly, men of letters, or some such order.

Lord DERBY thought the chronological order would be preferable to a division like that suggested by Mr. Scharf, as it would be more interesting and instructive. There was one question which he should like Mr. Scharf to answer, as he was the representative of the National Portrait Gallery. He should like to know how far they (the National Portrait Company), and other public bodies, would be justified in contributing from their own stores. How far, for instance, the trustees of the British Museum would feel themselves at liberty to assist. There was the Society of Antiquaries, again; how far would they be willing or able to contribute? In Downing-street there were apartments appropriated to the use of the Prime Minister, and in those rooms were portraits of past Prime Ministers arranged in successive order. Of course they would be very valuable if the Prime Minister would consent to their temporary removal.

Earl GRANVILLE agreed with the noble lord that it would be best to have a chronological arrangement. It was important to know what the action of the public bodies, such as the British Museum, would be.

Mr. SCHARF was certainly not entitled to speak authoritatively on the part of the authorities of the National Portrait Gallery; but when he had the pleasure of submitting to them the proposal of this committee, they at once expressed their cordial interest, and he thought they would do all in their power to promote the proposal.

The Earl of CLARENDON agreed with Lord Derby that the best arrangement would be that of chronological order. The pictures previous to 1688 would be most interesting, and the pictures which he had should be at the disposal of the committee.

Lord TAUNTON thought it was important that the proprietors of pictures should know, if possible, how long their portraits would be kept.

The Earl of DERBY said four or five months—April, May, June, and July—to be returned in August. What he thought was, that in April, 1866, there should be an exhibition of portraits coming down to the time of Charles II., or the Revolution; these pictures to be returned in August; and then, in 1867, an exhibition of those subsequent. If there were enough pictures for three exhibitions, then there would be another in 1868.

Lord Taunton suggested that busts should be included.

Mr. Cole stated that the building in which it was proposed to put the portraits would be thoroughly dry, heated by hot water, and guarded day and night. Letters had been received from the following, expressive of their cordial sympathy, and promising assistance:—The Duke of Buccleuch, Duke of Devonshire, Duke of Marlborough, Duke of Wellington, Duke of Cleveland, Marquis of Lansdowne, Lord Brownlow, Lord Spencer, Lord Claremont, Lord Sydney, Lord De L'Isle and Dudley, Sir Robert Peel, Mr. H. Hawkins, Mr. John Murray, the Dean of Christchurch, and others.

The Earl of Derby said they had received between eighty and ninety letters of assent, and only two or three of dissent.

Earl Granville then proposed the best thanks of the meeting to the Earl of Derby for his kindness in taking the chair, and giving them the suggestions.

The resolution was at once adopted; and the noble chairman having thanked the meeting, the proceedings terminated.

Manufactures.

Portuguese International Exhibition. — Arrivals from Oporto state that the Crystal Palace building is completed, and the annexes in an advanced state. The committee have, however, some intention of deferring the opening from August to September, in consequence of the very hot weather which prevails in August. The European countries are all filling up readily the space allotted them, and Great Britain will make a very fine display of her arts and manufactures. Messrs. Ransomes and Sims, of Ipswich, propose to fill the large space of 2,100 feet with Fowler's steam plough, steam threshing-machines, and various agricultural implements. Among the exhibitors of machinery, &c., are the Reading Iron Company, Messrs. Gwynne and Co., the Economic Permanent Way Company, N. Mills and Co., Birmingham. Tools and implements, &c., are also well represented by the Sheffield and Birmingham houses. In glass and pottery, among other exhibitors, are Messrs. Harper and Moore, of Stourbridge; Hope and Carter, Burslem; Maw and Co., Benthall Works, near Broseley; the Hill Pottery Company, Burslem. Messrs. Silver and Co. send furniture, portmanteaus, clothing, &c. Merryweather and Sons, one of their steam fire engines. Carriages are represented by Hooper and Co., and Thrupp and Maberley, of London; Storey, of Nottingham, and others. Textiles are represented in woollens by Joseph Craven and Co., of Bradford, and others; Linens, by Guynet and Co., and Johnson and Co., of Belfast; Irish poplins, by Pim Brothers and Co., of Dublin; while Dodge, Skill, and Co., and others, send India-rubber goods.

Cost of Iron Plating for Ships.—A correspondent, writing from Toulon, says that thirty-six plates for the armour of the *Taureau*, described as of *fer aciéré* and twelve centimètres, equal to 4⅔ inches English, in thickness, which have just been delivered at the arsenal of the Mourillon, cost 80,341 francs, and only represent about one-tenth of the whole of the armour of the vessel in question. He adds that the plating of the frigates of the type of the *Gloire* and *Provence* costs, on an average, 800,000 francs, or £32,000. In addition to this he says that, considering the power of the enormous guns which are being produced on all hands, the Imperial government has decided on using plates eight inches in thickness, and that the first application of such armour will be to the *Marengo*, which is now building at Toulon.

Commerce.

Shark, Ray, and Dog fish.—M. Duméril has recently made a communication to the Acclimatisation Society of Paris respecting the amount of products derived from these three fish, either for alimentary or industrial purposes, in which it is said, amongst other things, that the Hindoos sent during one year to the Bombay markets, for importation, no less than 229,240 kilogrammes, or 229 tons of fins of the white shark, taken off the east coast of Africa, the Malabar coast, and in the Red Sea. The quantity of dog-fish fins sent to China annually is said to reach on an average seventy tons, and the value is estimated at nearly fifty thousand pounds sterling. The amount certainly seems large for a portion of a fish which Europeans regard with so little favour.

The Tea Trade.—Messrs. Travers' *Circular*, of July 22nd, says:—The elections are now nearly over, but the excitement attending them has not been favourable to business, and it is probable that some weeks may yet elapse before this has entirely subsided; at present there seems to be little likelihood of any immediate change for the better. It would seem that the elections have affected this market more than that for any other article of produce; indeed the trade for tea appears to be particularly sensitive to the influence of passing events, and the article itself seems to be still regarded more as a luxury than as a necessary of life. It is not easy to estimate the effect which any general out door excitement, accompanied as it usually is by the free use of other stimulants, has upon the consumption of tea, but it must be considerable enough to diminish for the time the sales made by grocers, and as a consequence, the necessity for their laying in fresh supplies. On the whole, although the elections may have injured for the time the business of the regular trader, it must not be forgotten that by finding temporary employment and remuneration for many persons who have no regular income, large sums of money are circulated, and the power to purchase necessaries and luxuries is in consequence increased, so that there is a fair prospect of the loss being made up by subsequent larger sales. Meanwhile demand is still deferred, and it seems likely that its increase will be spread over a longer period, and be much more gradual than was at first anticipated. Even those who were the most sanguine as to the effect of the reduction must, by this time, be aware that its results are to be traced rather in steady augmentation of deliveries and a greater equality of value than in excited markets and speculative prices. The simultaneous rush which was predicted might have occurred had trade stocks been low, and had prices continued moderate, but as the very reverse of this was the case, there was no necessity and little temptation to purchase; everybody in consequence held off, and time was afforded for the excitement to cool down. As regards supply, the news brought by the last mail from China is on the whole of a satisfactory character, and seems to prove that no scarcity need be apprehended. It is true that the rebels are still in force in some of the tea districts, but their vicinity appears to exercise wonderfully little influence, and to increase rather than to diminish the prospects of an abundant supply. The opening price having also been higher than it was last year, manufacturers will be encouraged to push forward large quantities from the later crops, and it seems probable that the shipments of the present season will not be below the average. As regards quality, the news brought by the mail is not so satisfactory. So far as it was possible to judge from the first samples of the new crop received at Foo Chow, all the worst faults of last season's shipments appear to have been repeated, if not exaggerated. This is no doubt owing to hasty preparation, partly caused, it may be, by the proximity of the rebels, and partly by a desire to reach the market early, and so to obtain a higher price. The importance of India as a competitor for the supply of this market seems as yet to be scarcely recognized in China, and even to be totally ignored; but those who ship from the latter country may rest assured that unless the quality of their imports improves, and comes up to the standard of three years ago,

they will be left behind in the race, as fine tea will, under the new rate of duty, be more in demand than ever. Production is extending so rapidly in India, under the influence of European skill and energy, that the exceptional prices at present paid for its teas cannot long be maintained, and ere many years have passed the two competitors will meet on equal terms in this market, where, with the strict justice that is inevitably awarded in all large markets in valuations and sales, the preference will of course be given to the tea which combines the requisites of fine flavour and great strength.

Colonies.

AN EXHIBITION OF COLONIAL GEMS came off in Melbourne in May last. Diamonds from the Ovens River, near Beechworth, rubies, opals, garnets, sapphires, amethysts, cut and in the rough, from various parts of the colony, were on view, and excited much interest among miners and others. There can be little doubt that many thousands of precious stones have been thrown away among the "tailings" of wash-dirt and crushed stuff by reason of mining eyes not yet having become educated to the habit of recognizing and distinguishing one stone from another in its natural state.

THE COLONIES AND THE PARIS EXHIBITION.—Already the British colonies are beginning to take action in the matter of the Paris International Exhibition for 1867. A proportionably larger display of colonial products has been made at the Dublin Exhibition, than at any former exhibition, speaking relatively as regards space, for nearly one half of our colonies were represented there to a greater or less extent. The Australian colonies, Canada, and British Guiana, and other of our principal possessions were represented at the last Paris exhibition, and now a number of other colonies will take part in the exhibition, the desire to bring their various indigenous resources before the European world being strong. The immense indirect advantages flowing from these exhibitions are so palpable that no amount of eulogy devoted to them, however great, can be deemed thrown away. From Victoria we hear that a movement is already being made in preparation for the Paris Exhibition. New South Wales, Queensland, and Tasmania are sure to take part, and New Zealand and South Australia will also see the policy of taking action. The colony of Natal proposes to ask a vote of its Legislature of two or three thousand pounds, to make a noble exhibition of its various resources. It is proposed to get made up articles of utility or ornament, manufactured from colonial products, so that the raw material may be shown side by side with the manufactured article. Natal made a very creditable display of her products at the last London, and the present Dublin exhibitions, and will far outstrip them at the great Paris gathering.

WATER SUPPLY IN THE DARLING DISTRICT, NEW SOUTH WALES.—It may now be safely asserted that well sinking in the country to the north-west of the Darling has not proved a failure, as was some time since reported. Some attempts may have failed, but water has been obtained of good quality and in large quantities in various parts of the trans-Darling province, which consist, principally, as far north as the 29th parallel of latitude, o excellent sheep country. From the Barrier Ranges across to the Mount Searle Ranges (the "Far North" of the South Australians), a large number of wells have been sunk with great success. In the "Far North" five "runs" out of six are supplied entirely by means of wells. The depths vary from 20 to 120 feet, averaging about 60 feet, with an abundance of water, on which stock thrive well.

CUSTOMS DUTIES IN NEW SOUTH WALES.—The much vexed question of the Customs duties on the River Murray has at length been amicably settled. For several years past the Government of New South Wales have lost the duties to which they were entitled on goods brought across the River Murray from Victoria, the Government of that colony having persistently refused to enter into any arrangement for their collection. One consequence of that refusal was the establishment last year of Custom-houses on the border, which proved a source of serious loss and annoyance to the people on both sides of the river, as well as a great interruption to the intercolonial trade. Correspondence on the subject was re-opened between the two Governments, and it appears that the Melbourne Ministers admitted that New South Wales was entitled to the duties payable on goods consumed within her territory; and that an agreement, to last for six years, was entered into, under which the right of levying duties on the Murray was to be farmed by Victoria from New South Wales for an annual sum to be paid by the former in consideration of all duties to which this colony might be entitled, upon goods imported into it by way of the River Murray. The amount to which New South Wales should be proved to be entitled was to be subject to a charge of 5 per cent. for the cost of collection. What the annual worth of these border duties is has hitherto been only guessed at, and the conjecture has varied from fifty to a hundred thousand pounds. The real amount will now be accurately determined.

Publications Issued.

THE BREWERS' JOURNAL.—(No. 1, July 15th, 1865.)—Of this publication the first number has just appeared, and is presented as a supplement to the *Wine Trade Review*. In their preliminary statement the proprietors say:—"It is our intention to provide thoroughly reliable intelligence on passing occurrences affecting the trade. These accounts will be consistently brief, and will include much exclusive information of great importance which our peculiar position enables us to obtain. Disputed matters will be thoroughly sifted, and all *ex-parte* statements avoided. Our market reports and statistics will embrace all that the brewer, malster, hop merchant, grain dealer, agent, or commission-man can require. The statistics will be carefully compiled from the best sources, and will be so condensed as not to confuse the eye and understanding with repetition of figures. All the parliamentary Acts and statistical returns will receive punctual attention, and be so stripped of their official language as to make them intelligible at the first glance. Under the head of 'Notes of New Inventions' all new machinery, appliances, and processes, will be examined. No inducement shall turn us from the course we have adopted with our other journal—that of deciding in an impartial manner in cases where our opinion is solicited, and we feel in a position to give it. Our readers may rest assured that we shall never hazard an opinion. Where opportunity does not exist for the practical testing of a new invention, we shall confine our remarks to a mere description—with drawings if necessary—and the advantages claimed for it by the owner. The most useful among new patents will be brought before our readers, and a record kept of the various improvements from time to time introduced into our principal establishments. A column will be reserved for 'Correspondence' and a fair portion of our space will be set aside for free discussion, in proper terms, of special questions. We cordially invite this correspondence. Our 'Price Current' will contain the latest changes in the London market before the publication of each number The various special growths of hops will be distinguished, and no pains will be spared to render the figures correctly. 'Odd Items' will be a column devoted to the collection of small facts and rumours. Business changes, stoppages, failures, meetings of creditors, law notices, and the opening of new businesses, will receive particular attention; while scraps of trade news contributed by our subscribers will here find a place. In our 'Reviews' all new works bearing on the subjects upon which we treat will be fully noticed."

Forthcoming Publications.

Fires, Fire-Engines, and Fire-Brigades, with a History of Manual and Steam Fire-Engines, their Use and Management; Hints for the Formation of Fire Brigades and Remarks on Fireproof Buildings, the Preservation of Life from Fire, and the Volunteer and Paid Systems. Octavo. By Charles F. T. Young, C.E. (*Lockwood and Co.*)

Notes.

Railways in France.—It appears, by the returns published by the Minister of Public Works, that the total length of railways authorised between the years 1823 and 1850 was 3,525 kilometres; between the latter year and 1860, 11,390; and from the last date to December, 1864, 5,067 kilometres, making a total of 19,982 kilometres (a kilometre being rather more than six-tenths of a mile), very nearly 12,000 English miles. In addition to this total, more than 900 kilometres have been decreed, and are about to be carried into execution. The extent of lines actually in work at the present moment is a little more than 13,000 kilometres, or 7,800 English miles, or rather less than two-thirds of the entire amount decreed.

Railways and Telegraphs in Russia.—The Russian Government is actively engaged in extending its system of railways and telegraphs. A railway is now being constructed to connect the Lemberg line with Odessa, and another from Tchernovitz to Galatz on the Danube. The State has recently decided on the construction of another line from Krementchong and Balta, in connection with the trunk line from Odessa to Kharkof. The line from Dunabourg to Vitebsk is being carried out, and the company is bound to complete the work as far as Polotzk by November next year, and to open the whole line within twelve months more from that date. The necessary capital has just been raised for the formation of a railroad from Posen to Warsaw. The grand undertaking of connecting Russia with America by means of the telegraph, is being carried out under a treaty between the Imperial Government and the American Western Union Telegraph Company. This projected line is to pass through Nicolaief, Behring's Straits, the Russian possessions in America, and British Columbia, to St. Francisco, where it will be connected with the telegraphic system of the United States. The capital of the company is fixed at ten millions of dollars, of which nearly eight millions and a half are said to be already subscribed. The line is to be finished in five years, under forfeiture of the concession of the company, which is otherwise to last for thirty three years. Another important scheme is the continuation of the Prussian line of telegraph from Kiachta on the Tartar frontier, to Pekin, and a director of the Russian telegraphs has been for a long time in communication with the Chinese government at Pekin on the subject.

Patents.

From Commissioners of Patents Journal, July 21st.

Grants of Provisional Protection.

Anemograph—1839—S. B. Howlett.
Artificial light—1809—I. Baggs.
Breech-loading ordnance, carriages for—1801—F. A. Wilson.
Cast steel—1813—R. A. Brooman.
Clothes, washing, &c.—1827—H. Fearnley and C. Smith.
Coal dust, combining into lumps—1716—H. G. Fairburn.
Colouring, blue and violet—1585—E. T. Hughes.
Copper and nickel ores—1831—H. A. Dufrené.
Cotton, spinning and doubling—1391—C. Bradley.
Croquet, &c., marking progress in—1829—J. Soutter and T. Christie.
Draught beer—1781—T. S. Prideaux.
Fire arms—1805—R. Green and J. W. Heinke.
Fountains—1823—F. Taylor.
Gases from aqueous vapour—1841—H. Blair.
Gas-generator, portable pocket—1795—A. F. Morelle.
Grease from soap suds, manufacturing—1797—I. Peel and W. Hargreaves.
Guns, training—1799—H. D. P. Cunningham.
Harmoniums, &c.—1783—J. H. Smith.
Iron—1793—J. M. Macrum.
Iron safes, &c., preventing forcing of—1657—J. Parrish, C. Thatcher, and T. Glasscock.
Ivory and woods, imitation of—1682—M. D. Rosenthal and S. Gradenwitz.
Oxygen, obtaining—1833—H. A. Dufrené.
Paints—1807—G. Fentiman.
Paper hangings—1243—G. Josse.
Photographic agency, production of printing surfaces by—1791—J. W. Swan.
Pianofortes—1623—G. E. Way.
Potash and soda, sulphates and carbonates of—1785—C. F. Claus.
Pulping and compressing machine—1703—C. Worssam.
Railway and other springs, testing—1374—J. Mitchell and G. Tilfourd.
Reaping and mowing machines—1815—J. Byford.
Sewing machines, regulating—1835—B. Fothergill.
Ships and vessels—1817—C. O. Papengouth.
Signals on railway trains, communicating—1699—J. Nugent.
Spinning, weaving, and knitting machines—1440—H. E. Newton.
Steam carriages and adapting wheels for common roads to railways—1821—R. A. Brooman.
Tin and terne plates—1843—J. Saunders and J. Piper.
Trousers, "making up" of—1825—J. Jones.
Tucks and pleats, marking width of—1811—G. B. Woodruff.
Turntables—1681—C. Ravelli.
Vessels—964—J. Bethell.
Weaving, looms for—1803—J. Bullough.
Wood, turning and cutting—1773—J. Braithwaite.
Woollen or cotton cardings, rubbing or rolling—1619—T. Rothwell.

Invention with Complete Specification Filed.

Diving apparatus—1837—T. C. McKeen.
Manuscripts, &c., copying—1846—H. A. Bonneville.
Tobacco, utilizing waste of—1844—G. C. Collyer and C. L. Roberts.
Vessels, &c., raising—1838—T. C. McKeen.

From Commissioners of Patents Journal, July 25th.

Patents Sealed.

202. B. King.
215. S. L. Fuller, A. Fuller, and C. Martin.
226. A. A. Croll.
233. J. E. Massey.
237. J. Hind.
238. R. Helsham.
243. J. Twibill.
246. G. Haseltine.
249. V. Burq.
253. W. Clark.
271. M. Henry.
313. E. Hottin.
739. J. Seaman.
1368. T. Faucheux.
252. J. Raines.
254. E. Blakeslee.
255. E. T. Hughes.
261. W. Teall and A. Naylor.
262. J. Gibson.
264. G. Carter.
293. J. Maynes.
295. J. H. Johnson.
297. T. Routledge.
303. M. Blank.
304. W. Clark.
321. C. R. Markham.
322. J. Booth.
336. H. B. Barlow.
347. A. A. Larmuth.
394. E. J. Hill.
469. J. Graham.
507. S. Whitfield.
509. G. Haseltine.
570. S. Whitfield.
913. A. V. Newton.
914. A. V. Newton.
973. R. Maynard.
1082. J. Todd.
1185. W. E. Newton.
1371. W. Manwaring.
1380. E. A. Raymond.
1549. R. A. Brooman.

Patents on which the Stamp Duty of £50 has been Paid.

2044. J. Dickson.
2056. R. A. Brooman.
2057. C. A. Day and T. Summers.
2051. J. Willcock.
2088. T. King.
2104. H. Rawson and F. Staples.
2147. A. Boyle and T. Warwick.
2097. W. Clark.
2108. W. Clark.
2121. T. Sagar and J. Rocliff.
2175. A. V. Newton.
2176. W. E. Newton.
2096. A. Vignon.
2099. R. Bell.
2103. W. Clissold.
2110. H. A. Jowett.

Patents on which the Stamp Duty of £100 has been paid.

1764. A. V. Newton.
1674. D. Adamson.
1679. J. Taylor and J. Nimmo.
1656. J. B. P. A. Thierry.
1677. J. Cooke.

Registered Designs.

A Ladies' Cart—July 21—4731—J. Castle, Newark-upon-Trent.
Hardy's Printer's Hand-Press, double-acting Inking Roller—July 24—4732—A. Bell, 85, Gray's-inn-road.
Conical Roller, Blind Ends, Blind Boxes, and Fittings—July 25—4733—T. H. P. Dennis, Chelmsford, Essex.
Waist Buckle—July 25th—4734—R. and J. Walsham, Warstone Works, Warstone-lane, Birmingham.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, AUGUST 4, 1865. [No. 663. Vol. XIII.

TABLE OF CONTENTS.

Proceedings of the Society.

Musical Education Committee.

The following is the memorial of the Royal Academy of Music praying for the grant of a site on the Kensington-gore estate, addressed to the Commissioners of the Exhibition of 1851:

The directors of the Royal Academy of Music beg leave to submit, for the consideration of the Commissioners of the Exhibition of 1851, a statement of the nature and objects of this Institution, with a request that a site may be assigned to them on the estate at Brompton belonging to the Commissioners, for the purpose of erecting a building suitable for the accommodation of the Royal Academy of Music.

In the year 1822 Lord Westmoreland brought forward a plan for the establishment of an academy for the instruction of music in all its branches, for which, up to that time, no general school or institution existed in this country. This plan was approved of by his late Majesty George the Fourth, and, thus recommended, a considerable subscription was in a short time obtained, and the Academy was established in the following year.

In 1830 a charter of incorporation was granted, constituting the Institution a corporate body, under the title of "The Royal Academy of Music."

In 1834 a fourth part of the proceeds of the Great Festival in Westminster Abbey, amounting to £2,250, was given to the Academy, which sum was invested in the names of trustees, and the interest appropriated to the establishment of King's scholarships. Two scholars, one female and one male, are elected every year for the term of two years, so that there are always four on the foundation; these receive their musical education gratuitously.

The number of pupils received into the Institution since its foundation amounts to nine hundred and seventy-eight. Many of these now hold the first position in the principal orchestras of the country, many have distinguished themselves as vocalists, and some have sustained a high reputation as composers; and there can be no doubt that the great majority of the pupils, who have qualified themselves to act as teachers, have materially contributed not only to the present state of improvement in the art, but also to the establishment of a better system of instruction in the metropolis as well as in the country.

The number of students at present in the Academy is one hundred and twenty-one in all; namely, seventy-four females and forty-seven males; a strong proof of the high estimation in which it is held by those persons who are connected with the musical profession, more especially as, from the want of other funds, the students are required to pay nearly the whole expense of their education.

The income of the Academy has for some years been about £4,000, the greater portion of which, about £3,500, is derived from the contributions of the pupils. The interest on the funded property, £7,500, is £236, and the amount of the subscriptions about £300 per annum.

This short account will be sufficient to show the nature and objects of the Institution. As an educational establishment, the Royal Academy of Music has eminently fulfilled the purpose intended when the means at its disposal are taken into consideration. But the state of the funds has not, at any period, been in a prosperous condition; indeed, it has had to contend against pecuniary difficulties of such a character as, on more than one occasion, to threaten its very existence.

The actual amount of the funds, after all debts shall have been paid, is about £6,500, including the grant from the Westminster Abbey Festival. The committee, therefore, have only a sum of about £4,000 at their disposal to apply to any building purposes—a sum barely sufficient to make the necessary provision for the accommodation of the Academy in the event of a site being given up to it.

It might, however, be highly desirable to combine, with the rooms required specially for the use of the Academy, a large music hall, a music library, and rooms for the exhibition of musical instruments, which would not only be highly serviceable to the musical public generally, but have become almost necessary from the present advanced state of the art.

The cost of such buildings would probably be about £20,000, a sum far beyond what the directors of the Institution could provide. But as the large music hall might be available for other public bodies who might hereafter be located on the property of the Commissioners, some assistance might be obtained from them. A sum of money may possibly be obtained on debentures, to be issued on the security of the buildings, from persons interested in the advance of the musical art; it being understood that the large room might be let for concerts, or holding public meetings, under such regulations as may be approved of by the Commissioners.

The plans of any building proposed to be erected would, of course, be submitted to the Commissioners for their approval; but should it be necessary to incur any additional expense on account of external decoration or architectural ornament, the directors of the Royal

Academy of Music venture to hope, that for such expense they might receive some aid from the Commissioners.

Leinster.	George Clerk.
Wilton.	R. R. Vyvyan.
Howe.	A. F. Barnard.
Gerald Fitzgerald.	John Campbell.
Saltoun.	Quintin Dick.
Wrottesley.	Wyndham Goold.

April, 1856.

Proceedings of Institutions.

Huddersfield Mechanics' Institution.—The twenty-fourth annual report expresses great satisfaction in the fact that the number of pupils attending the classes shows a considerable increase over the previous year. This increase has been chiefly in the junior classes; the senior classes, although showing a slight improvement, have not been attended as numerously as the committee could have wished. The following is a statement of members, exclusive of annual subscribers and honorary members:—1863, fortnightly members 966; presentees 284; females 29—total 1,279. 1864, fortnightly members 1067; presentees 326; females 35—total 1,428. Payment from the pupils, 1863—£315 1s. 6½d.; 1864—£336 15s. Annual subscriptions, 1863—£289 16s.; 1864—£265 13s. The committee regret that the members have not availed themselves more of the advantages which the library offers, the issue of books during the past year being only 8,055 against 10,020 in the previous year. The committee have considered the desirability of purchasing a number of new books, in order to make the library more attractive. The fortnightly meetings have been eminently successful, and the best thanks of the committee are due to those ladies and gentlemen who have so kindly given their services gratuitously. The lectures and concerts during the past year were numerous. Amongst the former may be mentioned one by Mr. J. Bower, "Popular Delusions;" one by Mr. Thomas Westerby, "The Life of Barnum;" one by Mr. J. H. Bower, "Local Politics 500 years ago;" one by Mr. Frank Curzon, "Shakespeare a Workman;" one by Mr. W. F. Crook, "The Manners and Customs of the Chinese;" one by Mr. Wm. White, "Gold and its Properties;" also readings and recitations by Mr. Samuel Laycock, "The Lancashire Poet," and Mr. T. Collins, in the Lancashire dialect. The classes, 88 in number, continue to be the principal feature of the Institution. A canvass has been made amongst the working classes, and small bills have been distributed, pointing out the various advantages which the Institution offers. The best thanks of the committee are due to the voluntary teachers and penny bank assistants for their valuable services during the past year. The attendance in the classes was in 1863—52,739; in 1864—58,326. On the five evenings in the week nearly all the classes are engaged in elementary studies. On Monday, Tuesday, and Thursday reading from good text books, carefully explained by the teachers, forms the basis of the work; and in this way an outline of English history, geography, and some knowledge of grammar is given. On the Monday and Friday nights the classes throughout the Institute are occupied with writing and arithmetic. The drawing classes show a considerable increase in numbers, and the progress of the pupils during the year has been very encouraging. The average monthly attendance of this class was, in 1863—368; and in 1864—482. In connection with the drawing class the thanks of the members are due to Edward Brooke, jun., Esq., who, in the early part of the year, announced a prize of three guineas for the best design of a garden vase. From the drawings of the competitors—each of which are creditable—the judges awarded the prize to Mr. Wm. Catton. Mr. Brooke followed the offer up by another of six guineas, for modelling the vase from the drawing, and the work was being completed. The singing classes have made considerable advance. The average monthly attendance was, in 1863—164; and in 1864—208. The bookkeeping class keeps up its numbers. The loom class, though not so numerously attended as it ought to be in such a large manufacturing district as Huddersfield, has produced very satisfactory results. In the chemical class the number on the list is 32. The average attendance is 24. The French class has numbered twenty pupils, and the teacher reports their progress as satisfactory. The excursion to Liverpool, notwithstanding its many attractions, proved financially a failure. The weather was very unfavourable, and this in a great measure accounts for the want of success. The committee are greatly indebted to E. A. Leatham, Esq., M. P., for his kindness in permiting a gala to be held in Whiteley-park. The penny savings bank continues to be prosperous. In 1863, the number of depositors was 19,666; withdrawals, 3,805; amount of deposits, £2,045 1s. 1d.; amount of withdrawals, £1,690 15s. 2½d. In 1864, the number of depositors was 18,000; withdrawals, 4,148; amount of deposits, £2,037 16s. 6½d.; amount of withdrawals, £1,957 18s. 7½d. The number of accounts open December 31st, 1863, was 3,849. The number of accounts open December 31st, 1864, was 4,229. Mr. Walter F. Crook has resigned the secretaryship, and Mr. Joseph Bate has been selected as his successor. The cash account shows that the receipts has been £823 0s. 10d.; and that the balance in hand was £72 10s. 11½d.

EXAMINATION PAPERS, 1865.

(*Continued from page* 588.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

DOMESTIC ECONOMY.

THREE HOURS ALLOWED.

1. Enumerate under different heads what Domestic Economy embraces.

2. What circumstances would influence you in choosing a dwelling house? Show that a house at a low rent may be dearer than one at a greater charge.

3. What are the advantages and disadvantages of living in a town, especially with reference to bringing up a family?

4. Describe a simple and efficient method of ventilating a sitting-room containing an open fire-place.

5. A small bed-room, which has no fire-place, is lighted by a window, which does not open; explain fully why it would be dangerous to sleep in this room with the door shut; and say how you would establish a good system of ventilation in the apartment.

6. What are the objections to a crowded dwelling?

7. Is it an advantage to a labourer to receive his wages in small payments frequently rather than in large payments at greater intervals? Why, morally and economically?

8. Calculate the loss to a working man in the course of the year which would arise from his buying tea and sugar in small instead of large quantities, supposing the family to consist of six persons.

9. Give advice on the management of a family of six persons as regards

(*a.*) Food
(*b.*) Clothing
(*c.*) Dwelling

the wages of the father being 30s. per week.

10. What are the various disadvantages to the family of a working man where the mother is constantly employed away from home?

1. In out-door agricultural employment.
2. In the mills of the manufacturer.

11. How do the above employments affect the future prospects, in industrial life, of children whose mothers are so employed?

12. If you wished to secure a deferred annuity for life, to commence, for instance, at the age of 60, what is the most desirable way of doing so?

13. In what does the post-office savings bank differ from the old-established savings bank?

14. Calculate the relative cost of gas and candles; the gas-burner giving as much light as three tallow candles twelve to the lb., at 6d. per lb.; the three candles burning 1½ hour, and the gas-burner consuming 5 cubic feet of gas in the same time, the gas costing 4s. 6d. per 1,000 cubic feet.

15. How does breathing sustain animal life, and how does it warm the body? What articles of food are principally used by the inhabitants of very cold climates, and why?

16. Class the various articles of food under the heads of:—

(*a.*) Flesh formers
(*b.*) Heat givers
(*c.*) Bone makers.

What article of food combines the three to the greatest extent?

17. In a dietary for children would you allow more or less of flesh-forming food, in proportion, than for an adult? Why?

18. Show that cheap and easily-procured food may not be a constant blessing to the nation possessing it.

19. Can you account for the alteration which takes place in the moral and physical character of a poor Irish labourer after leaving Ireland for one of the colonies?

20. Write a short essay on the value of the potato as an article of food.

POLITICAL AND SOCIAL ECONOMY.

THREE HOURS ALLOWED.

First series to be answered if possible throughout.

1. Who, during this century, have been the most distinguished writers or legislators on subjects of political economy, and with what doctrines are the names of each most connected?

2. What are the four principles of taxation laid down by Adam Smith? Which of them is said to be contrary to the imposition of a duty on malt, and how is that made out?

3. What have been the most remarkable instances of reduced taxation during the last 20 years, and what has been the result of such reduction?

4. What are the objections to the employment of convict labour under the system of assignment, more especially in the case of the skilled labourer?

5. In what way, and from what sources, is London supplied with water; and on what principle is a limit put to the amount of dividend that may be paid to shareholders in water and other similar companies?

Optional Questions.

1. Compare the incidence of taxation on poor and rich.

2. What is the principle according to which the burden of supporting the poor should be apportioned?

3. What do you understand by the principle of reciprocity as applied to commercial treaties; and how far is that principle opposed to the principle of free trade?

4. What is the relation in which profit and interest stand to each other; and in what way does Mr. J. Stuart Mill differ from what he says to be the received notion on this subject?

5. What do you understand by "average" in mercantile language; and what is the difference between general and particular average?

GEOGRAPHY.

THREE HOURS ALLOWED.

1. Taking the *eastern* coast line of Britain, from the Firth of Forth to the mouth of the Thames, name in successive order the principal headlands, estuaries, river mouths, and seaport towns that fall within its range.

2. Enumerate, in geographical succession, the counties that lie along the west and south-west coasts of Scotland, from Cape Wrath to the head of the Solway Firth; also the principal seaports within those limits.

3. Make a list of the principal rivers of England and Wales, classifying them as they fall respectively into the German Ocean, the English Channel, the Bristol Channel, or the Irish Sea. Name a town situated upon each.

4. Write a brief account of any *one* of the countries of Continental Europe, describing its natural features, climate, productions, divisions, and chief towns.

5. Enumerate the North American colonies of Britain, stating briefly the leading characteristics of each, as to position, features, climate, and industrial resources.

6. Write a fuller account of Canada, stating the distinguishing conditions of its eastern and western divisions (Lower and Upper Canada), its industrial resources, and the position of its principal towns.

7. Enumerate the British Colonies on the Australian mainland, with the capital of each. Say which of them includes Cape York, the northernmost extremity of Australia? Which Cape Leeuwin, its S.W. point? Which Spencer's Gulf? Which Port Philip?

8. Draw (from memory) an outline map either of Canada, New South Wales, or Tasmania. Mark on it the chief natural features and the places of a few towns.

9. Give some account of Victoria (Australia): describe its coast line, chief inland features, climate, industrial resources, population (in round numbers), and chief towns.

10. Give a similar description of Queensland.

11. What is known respecting the constant, or periodical, movements of the atmosphere within the warmer latitudes of the globe. State, in general terms, their direction and limits, also the causes to which they are due.

12. What are isothermal lines? In what respect do they differ from parallels of latitude, and how can the difference be explained? Why do they rise on the western side of either continent, and sink as they are prolonged to the eastward?

ENGLISH HISTORY.

THREE HOURS ALLOWED.

N.B.—Dates are to be given in all cases.

1. What were the principal changes effected in England by the Norman Conquest?

2. What was the commencement of the House of Commons, and what have been the chief epochs in the growth of its power?

3. Describe the battle of Crecy.

4. Explain witan, socage, præmunire, impeachment, bill of pains and penalties.

5. What were the claims of Henry VII. to the throne of England?

6. What was the Covenant, and what were its effects?

7. Mention the chief events and measures of the reign of William III.

8. Give a short account of the American War of Independence.

Special Subject.

9. What were the effects of John's surrender of his crown to the Pope?

10. Give the provisions of Magna Charta.

11. Describe the battle of Lewes.

12. Write the life of Simon de Montfort.

(*To be continued.*)

COLONISATION; ITS ASPECTS AND RESULTS.*

By William Stones, Esq.

The Genius of Englishmen for Colonising.

This is doubtless primarily due to the influences of our geographical position and the geological character of our country.† If we examine a terrestrial globe, it will be found that Great Britain holds the advantageous position of lying close to, and yet detached from, the frontier of the Old World, of which it is the nearest point to the New World, the broad highway of the ocean spreading and stretching from the very doors of her central emporium to the most remote of her customers. This insularity causes easy accessibility from and to all quarters and nations, and gives a much larger amount of coast line than enjoyed by any other nation, as will be seen from the following table:—

Country.	Coast Line.		Square Miles of Surface.
Europe	1 mile to every	156	square miles of surface.
N. America...	1 ,,	228	,, ,,
S. America ...	1 ,,	376	,, ,,
Asia............	1 ,,	459	,, ,,
Africa	1 ,,	623	,, ,,
France.........	1 ,,	170	,, ,,
Great Britain.	1 ,,	57	,, ,,

Her abundance of harbours, and numerous rivers, although insignificantly small compared with many others in the world, being nevertheless of dimensions available for inland navigation, and unobstructed by rapids or waterfalls, conduce to the production of a numerous and bold population, accustomed to brave old ocean in his fiercest wrath.

In 1862 we are reported to have had an aggregate of 424,000 ships, of 61,600,000 gross tonnage, employed in our foreign and coasting trade; and throughout the year nearly fifty vessels, averaging 145 tons each, leave a British port every hour; while a fleet of some hundred yachts, starting on a great sea race from Cowes to Cherbourg—an unintelligible fact to most foreigners—attests the aquatic inclinations of our countrymen.

All English boys have an inborn love of the sea, and the most inland youth is quite willing to run the chance of sickness, provided he can have a sea trip.

With comparative equability of climate—such that the shortest days are sufficiently long, and the longest sufficiently temperate, to allow a reasonable amount of work being daily performed throughout the year—this island of ours is suitably placed for obtaining the largest possible result from human energy, being neither prevented by the short days and the extreme cold of the north nor by the excessive heat of more southern countries; and this expression of national energy, when at all impeded at home, seeks its manifestation abroad. Again, our mineral wealth, arising from the geological nature of the island, leads many seriously and coolly to face danger of another kind. The coal and metal miners of England number upwards of a quarter of a million of men—about a twelfth part of the male population of the country—and it is scarcely possible that this body of men can descend into the bowels of the earth, facing the dangers of such an employment, without being confirmed in their self-reliance and adventurous spirit.

Possessing an innate love of independence, and the national self-reliance greatly developed by their pursuits, if we add to the seafaring and mining divisions of the population the speculative spirit of the commercial class and the low condition of agricultural labourers, we find ample reasons and impetus for so many seeking abroad the accomplishment of their several desires, each emigrant finding in some one or other of our colonies a field suitable for his utmost exertions, the improvement of his fortune, and the acquisition of land, objects so zealously pursued by all Englishmen. The secluded habits of Englishmen enabling so large a proportion of them to exist without café, club, companion, or hotel, is a great feature in a colonising point of view. When his allotment or run has been selected, there he erects a hut or cottage, plants a garden, surrounds himself with a few pet dogs and birds, and settles down in his "home" for years. It is remarkable how even well and highly-educated single men will start off into the bush, and remain, with a herd of cattle or flock of sheep, hundreds of miles from any important town, with a probability of very rarely seeing a white companion other than their own shepherds or stockkeepers. Nothing but an indomitable and self-denying postponement of the present to the future could induce so many to undergo this self-banishment. Present self-restraint and confident persevering hope in the distant future, is the great secret of colonial success. Nor ought we to omit noticing the intense love of sport and general spirit of exploration and adventure which characterize many of those of our countrymen whose fortunes do not compel them to resort to a colony for their subsistence or pecuniary advantage. In a broad sense we may say that to English voluntary exertion most of the exploration of the world is owing, whether it be the north-west passage, the source of the Nile, or the traversing of Australia. All honour to these brave men, whether living or dead.

Effects of European Colonization upon Other Races.

For the purposes of this paper, and speaking generally, they may be classed into three groups:—Negroes—Asiatics—Other coloured races. The first have almost invariably been made slaves; the second have been incorporated and treated as fellow-subjects; the fate of the third has been extermination.

A somewhat melancholy reflection must often occur to those who have possessed opportunities of conversing with the original native inhabitants of our colonies, how almost universally there exists a deep-seated sentiment and fearful foreboding, in the minds of the thoughtful amongst them, and many such there are, that their race must disappear before the European.

A strong, firm conviction impresses them, rising at times to a kind of fatalism, that gradually, but as surely as the tide creeps up on the shore, their doom is either to retire, dwindle, and disappear before the pale-faces, to whom will pass the lands of their fathers,—or to die fighting a sad hopeless battle of despair, their feeble gods powerless to sustain them against the fiat of the white man's Deity. Their native habits and customs are unable to endure the shock of collision with a civilization to which they cannot conform, and whose vices tend to their rapid diminution; and the result is the same whether we take the case of the most warlike with whom we have come in contact—the New Zealanders, or on the other hand the very low race of Australians.

The following extract from a Tasmanian newspaper bears on this subject:—

"The *Hobart Town Mercury* notices the presence at the last government ball in that town of the last living male representative of the aboriginal race of Tasmania, accompanied by three aboriginal women, the sole survivors of their nation on the female side. It is estimated, with some degree of accuracy, that the natives numbered about 2,000 in 1830, but have of late years been rapidly disappearing under the "civilising" influences of the colonial government. In former times they were treated with great cruelty and barbarity by the colonists; but in the year mentioned a plan for transporting them to Flinder's Island, and keeping them there, was adopted. The result, which had been foreseen by many, is shown

* See the Paper read before the Society on the 3rd of May last (p. 405). The present article, which will be followed by others by the same author, treats of portions of the subject which time did not then allow Mr. Stones to touch upon.—Ed. *J. S. A.*

† See an able article on "The Causes of England's Greatness," in the *Quarterly Journal of Science*, by Mr. Pengelly, January, 1865.

by the four surviving individuals who were present at the governor's ball." The *Hobart Town Mercury* concludes its notice of this incident as follows:—"With whom does the blame of this rest? Most assuredly not altogether with the natives themselves. No one can say with truth that they were not as much sinned against as sinning in disasters that befell them. The original population is gone, and their extinction, as a race, was probably as inevitable as it is inscrutable. As savages they were found, as savages they lived, and as savages they perished. Such an event is deserving of some notice." Is it ever to be so? Is it a necessary law of this earth? Caribs, Red Men, Australians, Tasmanians, New Zealanders all cease, and their places are taken by the Anglo-Saxon race.

In all moderate climates Europeans seem to have supplanted the native races; only in the extremes of hot and cold countries has co-existence been possible; and even in hot climates, harshness of treatment, degradation, and slavery have been the leading characteristics of conduct on the part of the invaders, until, by the almost total disappearance of the aborigines, the necessities of the labour requirements of the colonies have had to be met by the introduction of the hardy African race. Whether, on the whole, that race has to thank or curse our colonisation is a difficult question to answer, as will be evident by a moment's consideration of the moral and social debasement brought upon Africa by its internal wars for the obtaining of slaves for sale, the miseries to which the poor wretches are exposed in transit, and the eventual condition of the slaves, without hope, family, or life, but at the will of others. Every thinking Englishman, who regards the contest recently concluded in North America must feel profoundly thankful that thirty years ago this country roused itself, at the loud call of noble men, some of whom are still amongst us, enjoying a green old age, to incur the expense of redressing a great moral crime, and at the large price of £20,000,000 the blot of slavery was removed from our flag and country. From the 1st August, 1835, no slave has been held by a British subject. Great cost, did we say? Can freedom be dear at any price! This price vanishes into utter insignificance when compared with the already huge avalanche of debt, some £600,000,000, which is rolling over the States of North America. Throughout that vast continent the serpent still gnaws on, poisoning the roots of all domestic, social, and political happiness, filling the national mind and soul with increasing discord and hatred—bitter, intense, and lasting—the distress of the widow and the wail of the orphan. Attempt to disguise it as we may, the question at the bottom is, slavery—property in human blood and bones—man a chattel. In the interval between the writing and printing these notes, four millions of human beings, without the slightest preparation, have been liberated from slavery. Time only will show whether the feared results will be realised. Truly slavery, whether in its initiative, continuation, or conclusion, is "a bitter draught."

As a memorial of the payment made to clear the British national conscience, the subjoined table of the compensation prices paid to the owners for their slaves in our several colonies may not be without interest; and I submit for consideration when the decay of some of the West India estates is so prominently brought forward, that as the principal item in the value of the properties consisted in the number of slaves, and as they were redeemed by the British public, it would be scarcely fair to expect the plantations to be as profitable as formerly, which seems to have been anticipated by many planters. Time is bringing about a better adaptation to the new state of society.

It has been stated that the emancipated negroes do not increase in numbers as they did whilst in a state of slavery, owing to vicious indulgences. But this statement seems hardly borne out by the population columns; and as the increase cannot be owing to any large influx of Europeans, and the immigration of Coolies can scarcely account for the increment, it must be inferred that the black population does not diminish, as has been supposed, but the contrary.

There is one point of view in connection with the surging

Table showing the Highest and Lowest Value of Slaves in the British Colonies, at the Time of the Emancipation; the Highest and Lowest Compensation given; the Number of Slaves in each; Gross Amount paid to each Colony; and the Population of each Colony in 1850 and 1861.

COLONY.	Average Value of a Slave as Appraised by Valuers.		Compensation Awarded.		Number of Slaves.	Amount of Compensation.			Population.	
	Highest.	Lowest.	Highest.	Lowest.					1850.	1861.
	£	£	£	£		£	s.	d.		
Jamaica	79	33	31	14	255,290	5,853,977	0	$11\frac{3}{4}$	377,433	441,255
Barbadoes	100	20	39	7	66,638	1,659,315	0	9	122,198	152,727
Trinidad	170	89	83	44	17,539	973,442	18	2	68,600	84,438
British Guiana	230	93	87	35	69,579	4,068,809	6	$4\frac{3}{4}$	127,695	148,026
Tobago	110	40	53	19	9,078	226,745	14	$10\frac{1}{4}$	13,028	15,410
Grenada	120	41	60	21	19,009	570,733	1	$7\frac{3}{4}$	28,927	31,900
St. Vincent	117	60	43	22	18,114	554,716	7	5	30,128	31,755
St. Lucia	120	40	50	17	10,328	309,658	17	9	24,516	26,705
Dominica	75	35	28	13	11,664	265,072	1	0	22,220	25,065
Antigua	146	32	35	7	23,350	415,173	14	$1\frac{1}{4}$	36,178	36,412
St. Kitts	80	29	40	15	15,667	309,908	5	$7\frac{1}{4}$	23,177	24,440
Honduras	225	69	109	29	1,587	96,571	9	6	—	25,635
Bermuda	108	28	31	8	3,314	48,253	18	10	11,092	11,461
Bahamas	80	19	34	8	7,734	118,683	13	$11\frac{1}{4}$	23,410	35,487
Cape of Good Hope	158	71	64	29	29,111	1,193,085	8	6	285,279	267,096*
Mauritius	144	52	56	20	56,699	1,986,099	8	$2\frac{1}{4}$	180,863	310,050
Montserrat	100	34	25	9	5,026	100,654	0	10	7,355	7,645
Nevis	62	30	24	11	7,225	145,976	19	$8\frac{1}{2}$	9,571	9,822
Virgin Islands	85	40	28	13	4,318	70,177	13	2	6,689	6,051

* 1856.

In addition to the pecuniary compensation given, the slaves, it will be recollected, were required to serve an apprenticeship for a term of years—six, if I remember correctly. One extraordinary item is found in the "Antigua" Account, consisting of an appraised value of a slave under the "Aged, diseased, or non-effective" class, 5d., and compensation, $1\frac{1}{4}$d.

over the native populations by the Anglo-Saxon race which must not be altogether omitted, and that is the fact, that where we do not exterminate them, we undoubtedly cause the lower classes amongst them to be treated with more justice than they received under the rule of their native chiefs or princes, and to that extent our governance is an advantage. India may be referred to as, on the whole, affording a satisfactory illustration of the improved condition, under our rule, of the lower classes of the population.

The demand for cotton appears to have thrown a bright and joyous sunlight upon India, and opened to the native population the road to a new status; and while this commercial advantage is felt by its myriad population, even to the very lowest, the wise institution of the Star of India is flattering to the higher classes, satisfying the Eastern craving for decoration. The double passions of wealth and distinction being thus gratified, the recipients are more firmly attached to the empire which confers these advantages upon them.

Fine Arts.

The Palais Schiarra at Rome.—The collection of Prince Schiarra, which contains some very fine works, amongst others, the "Violin Player," by Raphael; "Vanity and Modesty," by Leonardo da Vinci; a "Saint Sebastian," by Perugino; a "Portrait of Titian," by himself; and a "Magdalen," by Guido Reni, had a very narrow escape the other day when the palace was on fire. Their destruction would have been still more lamentable from the fact that, in consequence of a law suit amongst the heirs of the late Prince, the gallery has been closed for several years, and therefore the works are but little known to amateurs.

Rosa Bonheur.—This artist received the other day another, but rather costly, proof of the estimation in which her works are held. It will be remembered that some time since she was summoned by a dealer to deliver a picture which she had undertaken to paint for him, and which, for reasons not stated, she refused to do. The court ordered the artist, under penalties, to deliver the work within a given time; against this decision Rosa Bonheur has appealed, and the superior court has condemned her to pay M. Pourchet four thousand francs for not having fulfilled her engagement to paint for him, at a price specified, the picture in question.

Toulouse Exhibition.—The importance of the provincial exhibitions of pictures in France may be estimated by the fact that the late show of the kind at Toulouse—not one of the principal local exhibitions—included no less than 765 works of art. Of the artists exhibiting, about a hundred and seventy were of Paris, and about the same number belonging to the department of which Toulouse is the chief town.

Decorative Sculpture in Paris.—The façade of the new buildings of the Palais de Justice is just finished, and exhibits a large amount of sculptural decoration, including six colossal statues in granite—"Prudence and Truth," from the chisel of the late sculptor Duret; "Power and Justice," by M. Jaley; "Punishment and Protection," by M. Jouffroy. An emblematical figure of "The Law," also by M. Duret, is about to be placed at the head of a fine double flight of steps leading to the courts of assize; and over the porch of the same two cariatides supporting the tables of the law and a sitting figure of Justice, by M. Perrand.

Property in Works of Art.—A curious question of property in a work of art occurred the other day in Genoa. The picture of the Madonna, by Piola, on the wall of a house in the Rue des Orfèvres in that town, is well known to all artistic travellers. The property in this work has been for a long time contested by the authorities of the town, the proprietor of the house, and other persons. The matter has recently been decided by the Court of Appeal, which pronounced that the picture in question' which is on the public way, should be considered as public property, and not to be alienated for purposes of private speculation of any kind whatever! The evidence adduced before the judges is not given in the report, but it is to be presumed, in order to account for such a decision, that the origin and true proprietorship of the work were involved in perplexity, and that the only way of undoing the knot was to cut it.

Antient Silver Ware.—An interesting specimen of very old chased-work in silver has recently been discovered, during the demolition of a house at Toulon, believed to be of Roman construction. It is a *bénitier de famille*, or vessel for holding holy water, in a private apartment, and consists of a small cup or tazza, suspended by a chain from a winged figure, all in massive silver, and ornamented in *repoussé* by the hammer, in the style of the early period of the Christian era. It was destined to the melting pot, when M. Comte, a watchmaker, rescued it from destruction.

Manufactures.

Portuguese Exhibition.—The Portuguese authorities, by way of marking their appreciation of the readiness exhibited by the French government in contributing specimens of the productions of the Imperial factories of Sèvres, the Gobelins, and Beauvais, have called a special meeting of the commission at Oporto, and have passed an official vote of thanks to the Imperial government, at the same time nominating M. de Gérando, the French Consul at Oporto, and who was previously a member of the grand council of the exhibition, a member of the central executive committee.

Bismuth.—This metal has of late years risen considerably in price. Amongst other causes, some journals have stated that two or three years ago a company was formed to work an invention by which gold was to be made by the transmutation of bismuth into that metal, and that large quantities of the former metal had been bought up for this purpose. Whether such an enterprise was or was not entered upon does not appear. The following is a list of the prices:—

1844	10d.	to	2s. 0d.	per lb.	
1845	2s. 0d.	,,	4s. 0d.	,,	
1846	4s. 0d.	,,	3s. 3d.	,,	
1847	3s. 3d.	,,	2s. 6d.	,,	
1848	2s. 6d.	,,	2s. 0d.	,,	
1849	2s. 0d.	,,	2s. 6d.	,,	
1850	2s. 6d.,	2s.,	2s. 6d.	,,	
1851	,,		,,	,,	
1852	,,		,,	,,	
1853	,,		,,	,,	
1854	,,		,,	,,	
1855	,,		,,	,,	
1856	,,		,,	,,	
1857	,,		,,	,,	
1858	2s. 6d.	to	3s. 6d.	,,	
1859	3s. 6d.	,,	4s. 6d.	,,	
1860	4s. 6d.	,,	6s. 6d.	,,	
1861	6s. 6d.	,,	9s. 6d.	,,	
1862	9s. 6d.	,,	20s. 0d.	,,	in July.
	11s. 0d.		...	,,	in Dec.
1863	11s. 0d.	,,	10s. 6d.	,,	
1864	10s. 6d.	,,	11s. 0d.	,,	
1865	10s. 6d.	,,	11s. 0d.	,,	

Up to 1844 a large quantity of bismuth was produced in this country from cobalt ores in the old way of refining, but a new way of treating such ores, then introduced, necessitated the loss of much of the bismuth, and since that time we have been chiefly supplied from the Saxon and Bohemian mines. In 1845 there was a large demand for a composition to make rollers for calico-printers, raising the price for a few months. In 1858 the

supply began to fall off, and in 1861-2 there was a very large extra demand for medicinal preparations, which, to a certain extent, still continues, but the demand for mechanical use has since that time been very trifling. New sources of supply are opening, and prices, it is said on good authority, are likely to fall.

The Silkworm culturists in France announce the birth or hatching of the larva of the *Bombyx atlas*, an enormously large silk moth. This gigantic moth has never before been seen alive in Europe; and if it can be introduced into France it will prove of the greatest commercial value. Its cocoon is extremely large, and weighs nine grammes, whilst those of the ordinary worm do not exceed two grammes in weight. The grub lives on the leaves of a species of barberry shrub.

New Mode of Preparing Wort.—The *Brewers' Journal* states that an invention has been registered by M. Hychert, of Paris, for a new way of preparing wort in the making of beer. His plan is as follows:—"I throw upon the ground malt, intended for the vat, enough cold water to form a thick mass. I take care to mix well the malt, to let the water penetrate into all its parts. I then let the mixture remain for about an hour, to obtain the dissolution of the diastase; at the end of that time the excess of water is let out containing the dissolved diastase. Stirring well, I add to the mass in the vat or copper, whichever it may be, which still contains a notable quantity of diastase, a sufficient quanity of hot water to arrive at a temperature of 75 deg. The mixture being perfectly homogeneous, I let it remain some time, and then boil it or let it attain at least a temperature of 90 deg., be it in the vat (if there is a way of introducing steam) or be it in the copper, but mind and stir it well, or the malt will adhere to the sides of the vat or copper. Keep it boiling for about an hour, taking care to stir it constantly; remove it then to the vat (if the boiling has been effected in a copper), and let it cool down to 75 deg.; now should be added the best part of the dissolved diastase, which being nearly cold, produces a fresh coldness. All this should be done whilst stirring, which must be continued for some time afterwards. Let the mass stand for about another hour, and then let off the wort, which, if the tempering has been successful, should be quite bright and clear, having a soft and agreeable taste. You may now add to that remaining in the vat the rest of the dissolved diastase and enough water to raise the temperature to 75 deg., and again proceed in the manner before advised. If the malt in the first place has been properly ground from the first tempering, nearly all the starch will have been turned to sugar; but if the ground malt has not been enough crushed, you make with profit a third or several temperings, in which case you must be careful of your diastase. By this proceeding all the existing starch is converted into sugar, which augments considerably the quantity of wort, and makes it singularly bright and clear; it does not contain any particle of amidine, and is perfectly free from dextrine; and, again, being nearly all sugar, it results that the beer manufactured has a very agreeable taste, and will keep a considerable time without turning sour."

Commerce.

The French Wine Trade.—The vines everywhere promise well, presenting a brilliant aspect, which induces great hopes both in respect to quality and quantity. In most vineyards the vintage will begin early this year.

German Yeast.—The payments made for German dried yeast during the last ten years will probably excite some surprise from their magnitude. In 1855, the value of this import was £143,851; in 1856, £171,374; in 1857, £180,378; in 1858, £111,539; in 1859, £172,215; in 1860, £184,079; in 1861, £186,337; in 1862, £204,404; in 1863, £209,837; and in 1864, £231,748; a yearly increasing amount, and forming an aggregate value in the ten years of more than one million and three-quarters sterling for this simple article.

Chinese Tea and Silk.—The shipments from Chinese ports to the latest dates were 117,913,545lbs. of tea, being 722,202lbs. above last year's export, and 30,719 bales of silk, nearly 10,000 bales less than last season.

Hops.—While the import of foreign grown hops appear to have fallen off this year, they have very greatly increased since 1850. In that year the imports were 6,479 cwt.; in 1854, 119,040 cwt.; in 1861, 149,176 cwt.; and in 1863, 147,281 cwt. The value has increased considerably. In 1860, £568,901; in 1861, £657,763; in 1862, £723,034; in 1863, £626,660; in 1864, £549,863.

Timber and Wood.—There seems an increasing demand for timber, judging by the increase in the imports of last year. In 1855 the value of the timber and wood imported was £3,567,870; in 1860, '61 and '62, an average of £4,500,000; in 1863 and '64, nearly £5,000,000. Of these sums foreign timber and wood contributed in 1855, £1,645,108; in 1860, £2,238,021; and in 1864, £2,569,585.

Wool.—There is not an active demand for English wool among the staplers in the manufacturing districts, and the collectors of wool do not find it easy to sell at rates current a few weeks past. There is, however, more than an average consumption, and prices can hardly be quoted lower. The manufacturers are well employed in the clothing districts, and the value of colonial and other wool is well sustained. The progress of the woollen trade has fully kept pace with, and perhaps outstripped, the advance in the imports of the raw material. Thus the value of the woollen and worsted manufactures exported from the United Kingdom in 1850, was £8,588,690. In 1853 it made a bound to £10,172,182; in 1859 they made another great stride, going to £12,053,708. In 1862 they rose to £13,148,431; and, in 1864, to £18,566,078. Last year's figures were of course swollen by the high price of raw material, but 1864 was, nevertheless, a progressive period. These details refer wholly to the export trade; but the home demand for woollen and worsted goods has also immensely expanded during the last fifteen years.

Beet-root Sugar.—The following is from the *Journal des Fabricants de Sucre* of July 27th:—"Floods of rain have followed the violent storms which have borne devastation into the North, l'Aisne, l'Oise, and La Somme; the beet-root again shoots forth vigorously, but has in many places lost its leaves from the effects of the hail, while the grey worms or other insects continue, wherever they have settled, the course of their destruction. Such are the salient facts of the position of a crop the appearance of which begins to manifest itself, although its result is yet difficult to estimate. Thus, as we have previously said, a good part of the crop, about two-thirds, is out of the question; its return will reach probably more than that of the average; as to the rest it is impossible to make the least valuation. With these late rains it is to be feared that the plant will for a long time remain green, and will then ripen badly. On the other hand, the beet-root which has lost its leaves will be retarded, and the new leaves will form to the prejudice of the saccharine part. In Germany and Belgium where they suffer the same phenomena of temperature as in France, there exists also a great deal of uncertainty about the future of the crop, which everyone agrees to consider as incapable of exceeding that of the past year, which, in the Zollverein, reached the amount of 165,000 tons, and which, compared to a normal year, such as that of 1862-63, was much better than in France. Taken altogether, it seems to follow from this information and these estimates, that, on the whole, there will be this year in Europe at least as much sugar as last year, and that the surplus, if surplus there should be, depends entirely on the temperature from now to the end of September, that is to say, from

the last shoot of the beet-root to its ripening. The ravages wrought on the beet-root by numerous worms, continue to form the chief object of thought with them and the growers, who seem justified in feeling surprised that no official commission has been charged with the study of this question, on which depends, in a great measure, the future of one of the most considerable trades of the country."

Colonies.

Telegraph to Melbourne.—Melbourne has been brought into telegraphic communication with London by the opening of the Anglo-Indian line. The first press message received in Victoria was published in the Melbourne *Argus* of the 19th April. It was despatched from London on the 20th March, and but for an unfortunate accident to the steamer *Madras*, it would have been delivered in Melbourne on the 13th April, or just 23 days after its despatch.

The East Darling District, New South Wales.—An interesting report has been drawn up by the Assistant Commissioner of the Albert district of a tour through what has been known as the dry country, to the east of the Darling, and lying between that river and the Lachlan. Mr. Byrne's journey extended over 700 miles of this country, and his report as to its capabilities is favourable. Three or four years ago the occupation of this country was considered remote; the river frontages were taken up by settlers, but it was thought dangerous to settle beyond the reach of the river. But the completion of the railroad to Echuca, together with the increased supply of steamers on the Darling, has lessened the difficulties of transit, and given a greatly increased value to the land. The necessity for finding fresh pastures for the increase of flocks and herds, together with the emigration of squatters from Victoria, has stimulated the demands for sheep runs in this district, and so far as the taking up of fresh pasture land is concerned, this portion of the colony of New South Wales has been the most progressive. Mr. Byrne, in his report, divides the country he traversed into four varieties—the mountainous, the undulating, the salt bush and the scrub. The first three can be mostly utilized; though some of the more mountainous portions seem too rugged to be very inviting. The salt bush country is not all plain, as has been generally supposed, though there are very large stretches of level country in it; the gullies in this broken country may hereafter be found to offer fine opportunities for making dams for the stowage of water. On the flat country Mr. Byrne felt the want of water very much, and his party was on one occasion three days without it. The creeks that run down from the hilly country soon vanish, as the soil is very absorbent. Wells and tanks are absolutely necessary for the plain country. Except in localities where irrigating canals can be cut from the river, Mr. Byrne does not speak of permanent water anywhere; even in the mountainous districts the larger creeks do not appear to retain water for more than three or four months after rain. The formation in these ranges is mostly limestone, which is not considered the best for the production of nutritious grasses. The undulating country contains a fair supply of timber; the soil is a soft, red loam, and bears a very good herbage. It is heavy to travel over, and it will probably be found that railroads are the best roads for Riverina. Across the level country lines suited for the traffic could be made for £3,000 to £4,000 per mile.

Provision and Labour Market in the Colonies.—The following Table, extracted from Messrs. Silver and Co.'s "Emigration Circular," gives the prices of provisions and the wages of various classes of labour in the colonies, at the dates mentioned:—

	PROVISIONS.									LABOUR MARKET.									
	Retail Prices.									Country.							Town.		
										Per Annum with Rations.							Per Day.		Per Year.
	Beef per lb.	Mutton per lb.	Pork per lb.	Potatoes per cwt.	Butter per lb.	Cheese per lb.	Tea per lb.	Bread per 4lb loaf.	Flour per 100lbs.	Carpenters and blacksmiths.	Ploughmen, stockmen, and shepherds.	Married Couples Shepherding.	Gardeners, coachmen, &c.	Farm and garden labourers.	Married farm and domestic servants.	Female servants, town and country.	Skilled artizans.	Day labourers.	Grooms, coachmen, and gardeners.
	d. d.	d. d.	d. d.		s. d. s. d.		s. d. s. d.			£ £	£ £	£ £	£ £	£ £	£ £	£ £	s. d. s. d.	s. d. s. d.	£ £
Victoria (Melbourne), May, 1865	4½ to 6	4 to 6	8 to 10	...	2 6 to 3 9	9d. to 11d.	...	9½d. to 10d.	...	...	...	...	...	...	45 to 70	20 to 30	...	...	...
New South Wales (Sydney), March, 1865	2½ to 3	2½ to 3	7 to 8	6s.	1s. 4d.	6d.	1 6 to 2 0	10d. to 11d.	22s.	...	30 to 35	40 to 50	50 to 100	...	£50	20 to 25	10 0 to 15 0	5 0 to 6 6	...
South Australia (Adelaide), May, 1865	5 to 9	5 to 7	8 to 10	9s. 4d.	1 6 to 2 4	1s.	...	11d.	28s.	65 to 78	39 to 52	52 to 65	40 to 60	45 to 52	60 to 70	18 to 26	7 0 to 12 6	6s.	...
Queensland (Brisbane), Apr. 1865	3d.	4d.	8d.	9s.	1s.	1s. to 1s. 6d.	2 6 to 3 0	1s. to 1s. 1d.	25s. to 28s.	...	35 to 60	45 to 60	40 to 60	35 to 50	50 to 65	18 to 30	10s.	6 0 to 8 0	50 to 80
Wellington, N.Z., May, 1865	7d.	6d.	6d.	6s.	1s. 3d.	1s. 2d.	3s.	1s.	27s.	...	£45	60 to 65	£50	£40	50 to 60	25 to 30	12s.	6s.	£40
Nelson, N.Z., Jan. 1865	7d.	8d.	10d.	8s.	1s.	1s. 6d.	3s. 6d.	1s. 2d.	25s.	...	...	...	...	...	...	...	...	...	...
Otago, N.Z., May, 1865	6 to 10	6 to 9	1s.	5s.	1 6 to 2 6	1s. 6d.	2 6 to 3 6	11d.	30s.	...	50 to 70	65 to 100	50 to 90	50 to 70	...	30 to 50	10 0 to 15 0	8s.	50 to 90
Natal (Durban), Feb. 1865	6d.	8d.	8d.	8s.	1s. 6d.	...	3 6 to 4 0	1s. 4d.	32s.	...	£96	...	...	...	...	...	8s. 6d.	6s.	...
Buenos Ayres, June 1864	2d.	1¾d.	...	50s.	3s. 6d.	2s.	3s.	8d.	35s.	...	£30	£45	£40	£40	£40	20 to 25	7 0 to 8 0	4s. 6d.	...
Argentine Republic (Rosario), Sept. 1864	¾ to 1	1 to 1½	...	6s.	3s.	3d.	3s.	1s.	15s.	...	£30	£40	...	£28 16s.	£40	30 to 36	6 0 to 10 0	5s.	...

Publications Issued.

Les Œuvres de Lavoisier. Edited by M. Dumas. 3rd volume. Paris.—M. Dumas, of the French Institut, has just presented the third volume of the works of the famous chemist Lavoisier to the Academy of Sciences of Paris. All the world knows how vast were the services of that great chemist, but few are aware, perhaps, that he fell a victim on the scaffold. M. Dumas' work will greatly increase the interest that surrounds the name of Lavoisier, who was not only a chemist, but a labourer in almost all branches of physical science. Amongst the few practical remains of his labours that exist is a gigantic thermometer which Lavoisier constructed, and which still exists in the cellars of the Observatory of Paris. The object of this instrument was to exhibit variations of temperature however slight, and each degree is represented on the scale by a space of four inches. It appears, according to the statement of the Imperial astronomer, M. Le Verrier, that its indications do not agree with those of other instruments, and it is proposed by him that another instrument should be constructed on the same scale, in order to correct this discrepancy. It appears also that Lavoisier contributed largely to the scientific and administrative reports which appeared under the name of his friend Bailly, who fell with him under the revolutionary axe; the notes left by Lavoisier on this subject are very extensive, and M. Dumas has included the substance of them in the volume which has just been presented to the Academy of Sciences.

Notes.

Public Works in Paris.—The extent to which demolitions, changes, improvements, and ornamentation are being carried on in Paris is already without parallel; but it appears that what has been done during the last dozen years is, after all, merely a commencement. The Prefect of the Seine has asked for the large sum of two hundred and fifty millions of francs, or ten millions sterling, to carry on the work of transformation, and the Corps Législatif has acceded to the demand, backed, as it was, by the Imperial Government, but with a protest in the form of a minority of 50, the majority numbering 173. The question is a mixed one, composed of political, social, and industrial elements. One party argues that the amount of work projected is far too large, and the expense ruinous; another that the workmen of certain trades, such as masons, carpenters, joiners, and painters, are being drawn to the metropolis in vast numbers, to the detriment of other parts of the country, with the further danger of their own demoralisation from the fact of their being withdrawn from their families and their connections, and flung into the turmoil of a luxurious and crowded city, where living is dear, and temptation to excess of all kinds great, and, in addition to all this, with the possible danger in prospect of an end of the work, a great fall in wages, and general discontent; a third holds that, however desirable may be the changes projected, it would be far more economical, and more conducive to the general well-being and comfort of the population, if execution were spread over a greater space of time. These are no doubt very serious questions, and deserve the attention of all political and social economists, who, moreover, can hardly expect ever to have such another extraordinary case presented for their study as that now furnished them in Paris. The large sum in question is to be raised on terminable annuities of sixty years, the issue of which is to be spread over a term of four years. Of course the exact application of the whole of this money cannot yet be known; but some important items are already settled. In the first place, the cost of piercing new streets and opening up various parts of the town, which are now crowded, ill-drained, and inconvenient, is estimated at seventy-five millions, or three millions sterling. Another great work is the conversion of the old military road, which now forms the outer ring of Paris, into a series of noble boulevards; the present road is only about thirty feet in width, the new boulevards will be four times as wide, and will be planted with four rows of trees, two rows on each side, with a promenade between. The entire length of these new exterior boulevards will be more than twenty miles. An immense garden or pleasure ground is being made at the Buttes Chaumont or Saint Chaumont, lately one of the wilds of Paris, a huge irregular piece of ground where plaster quarries have existed for centuries. The new *parc* will cover more than fifty-five acres. The ground, having been excavated in parts to depths of from one to two hundred feet, will be partly laid out in terraces, and one great hollow is being converted into a lake of considerable size. On a promontory is being constructed an exact counterpart of the Temple of the Sibyl at Tivoli. This park will be a great boon to the population of this almost inaccessible and heretofore deserted part of Paris. Amongst the buildings to be executed are, the new opera house, which is considerably advanced, and the Hôtel Dieu, which is to be rebuilt. The reconstruction of this hospital has given rise to much controversy, there being a strong opinion against its re-erection on a small island, but the opposite party has triumphed, and the new Hôtel Dieu is to be built, according to the plan proposed some time since, and published in the *Journal*, on the same island but on the opposite bank to that occupied by the existing hospital. It will be nearly in face of the Palais de Justice, and behind the new Tribunal of Commerce, will cause the suppression of nearly all the old narrow streets still existing in that half of the old city, and will have the Seine and the Quay Napoleon on one side, and wide avenues on each of the other three sides. The counter project of erecting only a small hospital of reception on the island, and a much larger one, in direct communication with it by means of an underground railway, in a more salubrious situation away from the river, was rejected on account of the alleged inconvenience which would result from its adoption, not only to the patients themselves, but to the medical men and pupils of the medical schools. Amongst the improvements to be introduced into the new hospital are mentioned the placing of the kitchens, bath-rooms, store-rooms, and other subsidiary departments in the underground floor, and the connecting the whole together by means of a railway. The ground floor, as well as the upper stories of the building, are to be devoted to sick wards, each being provided with a spacious parlour or day gallery, washing rooms, and a shaft down which soiled linen and everything to be got rid of will descend direct to the vaults underground. A lift, large enough to hold a man sitting or lying, is to serve the whole of the floors. Amongst the more ornamental works now in course of execution or to be carried out, are, the placing of sixty new candelabra on the Place de la Concorde, which is already lighted by as many such lamps, and by eight rostral columns, each carrying two lights; the place will be illuminated by no less than a hundred and thirty-six large gas jets. The number of lamps along the whole length of the avenue of the Champs Elysées is also to be doubled. The angular spaces opposite the front of the Church of the Madeleine have been planted with trees of several years' growth, and supplied with fountains, flowers, and seats, fixed and moveable. The decoration of the walls of the great court of the Hôtel des Invalides, with mural historical paintings, by M. Masson, is proceeding rapidly, and those portions which are finished are spoken of favourably. The Hôtel de Ville is being thoroughly renovated, outside as well as inside; and amongst other decorations in hand is that of the Municipal Council Chamber by the painter Yvon. The subjects selected for this purpose are four episodes memorable in the history of the city: Clovis, habited in Roman purple,

making his entry into the capital; Philippe Auguste placing his children under the protection of the Municipality of Paris, previous to his departure for the Holy Land; Francois I. laying the first stone of the Hôtel de Ville; Napoleon III. signing the decree annexing the suburban communes to the City.

Collection of Leaden Antiquities.—The city of Paris has just purchased, for the sum of eighteen thousand francs, a very curious collection of old objects in lead and pewter found in the Seine. These leads, as they are called, are mostly cast, but in some cases are hammered *repoussé* work, and are divided into nine groups—Badges and insignia of the old industrial corporations; those of religious fraternities; those of officials attached to the church; and those worn by persons connected with the royal household; medals; pilgrims' badges; popular images; political emblems; and miscellaneous. The collection has been placed in the library of the Hôtel de Ville.

Danger of Touching a Body Struck by Lightning.—M. Bourdin, who has reported to the Academy of Sciences of Paris on the effects of lightning, from the year 1835 to 1863, gives two extraordinary instances of persons being injured by contact with the bodies of others who had been struck. In one case, which happened in June, 1854, a man was killed by lightning near the Jardin des Plantes, and the body remained for some time exposed to heavy rain. When the storm had passed two soldiers were about to raise the body, when they both received violent shocks. In the second case, two artillerymen were ordered to raise up some telegraphic posts which had been thrown down during a storm at Zara, in Dalmatia; they took hold of the telegraphic wires, felt first a slight shock, and then were immediately afterwards thrown down. Both had their hands burnt, and one was killed. The other, in attempting to rise, fell immediately upon touching the elbow of a comrade who had run to his aid. This last was also thrown down, experienced a severe shock, and his arm was burnt at the place where the other had touched it. To avoid the danger of such secondary accidents, M. Bourdin recommends the discharge of the electricity from the mouth or other part of the body first struck by means of a whisp of straw, or some such conductor, placed in communication with the earth, taking care, of course, to surround the same with a good non-conductor at the parts where it is taken hold of.

Patents.

From Commissioners of Patents Journal, July 28th.

Grants of Provisional Protection.

Automaton lay-figure—1788—W. E. Gedge.
Blinds, rollers for window—1847—W. Meddowcroft.
Bolts, rivets, and spikes, metallic—1796—E. H. Waldenstrom.
Boxes—1789—A. V. Newton.
Bricks—1748—W. R. Lake.
Bridges, aqueducts, &c., suspended—4765—S. B. Labouret.
Carpets, paper as a substitute for—1873—A. H. Platt.
Carriages, axles for—1762—S. Wright.
Carriages, break for wheel—1810—W. E. Newton.
Casks or barrels, setting up—1764—W. Clapperton and A. Lyle.
Castings, compound metallic—1885—G. Nimmo.
Chains, bracelets, necklaces, &c.—1794—P. M. C. Béziel.
Coffins and air-tight receptacles—1804—J. George.
Confectionery, pearled or ornamented—1819—H. Schooling.
Copper and gold, separating gold from ores containing—1855—A. E. Molin.
Cotton, doubling and drawing—1739—F. Delamare-Deboutteville.
Crinoline steel, &c., protecting—1883—W. Edwards.
Engines, locomotive—1754—C. de Bergue.
Engines, traction—1836—M. H. Keene.
Envelopes, securing—1853—S. Tripp.
Fences and baskets, ornamental—1806—W. Goulding.
Fibres, producing—1881—H. E. Gilles.
Food for horses—1826—R. Hineson.
Fustian, machinery for cutting—1814—B. Collins and J. Butterfield.
Gas, ammoniacal liquors for purifying—1818—G. T. Livesey.
Gas meters, dry—1732—G. Lizars.
Gas tubing, flexible—1861—W. R. Lake.
Generators, steam boilers or—1869—A. Barclay.
Guano, &c., artificial—1877—D. McCrummen.
Gun barrels—1738—H. P. Tipper.
Handles of smoothing irons, &c.—1798—T. Sheldon.
Locks and keys—1812—J. F. Heather.
Locks and latches—1782—G. Carter.
Mats, matting, and brushes—1758—G. and D. Hurn.
Mattress—1863—S. Dummere.
Metals, ingot moulds and casting—1849—J. Clayton.
Oils, lamp—1768—W. Jenkins.
Optical illusions, production of—1588—G. Bonelli.
Organs, harmoniums, &c.—1802—J. Hopkinson and J. Whitelock.
Oxygen, producing—1780—H. Beigel.
Paper board and paper, machinery for making—1787—J. F. Jones.
Paper board, machines for making—1756—J. F. Jones.
Petroleum, decantation and raising of—1724—P. Jacovenco.
Pianos, tuning—1742—R. A. Brooman.
Pitch, dissolving—1770—R. A. Brooman.
Presses—1859—W. Hughes.
Railways, permanent way of—1842—J. E. Wilson.
Reaping machines—1824—W. S. Underhill, A. H. Corden and J. Corden.
Sheet metal, cutting, punching, and bending—1728—R. H. Leese.
Shoeing horses—1887—T. H. Ince.
Signal for calling cabs, day and night—1113—E. Wilson.
Signals on board ships—1772—F. H. Gisborne.
Steam boilers, preventing the incrustation of—1734—W. E. Newton.
Steam, generating—1622—M. P. W. Boulton.
Steel, conversion of iron into—1776—J. Jobson and J. F. Dickson.
Steel, &c., strengthening shields of—1226—T. H. Campbell.
Smoke, apparatus for consuming—1697—W. Clark.
Switches, railway—1786—J. H. Johnson.
Telegraphs, electric—1784—W. Thomson and C. F. Varley.
Tents or chambers for photographers, portable dark—1808—J. Willis.
Tobacco, &c., pouch for holding—1871—W. A. Richards.
Trains, signalling, lighting, and communication between all parts of—1492—R. Howarth.
Type, apparatus for composing—1845—A. Mackie and J. P. Jones.
Vapours and gases, cooling or condensing—1875—T. Metcalf, H. Metcalf, and T. Clayton.
Vessels, propelling—1752—J. Calvert.
Volatile liquids, self-acting apparatus for obtaining a circulation of—1816—H. A. Dufrene.
Washing machines—1744—W. H. Davey.
Waterclosets, supplying disinfecting liquids to—1879—C. Nicholas.
Water, apparatus and equipments for persons employed under—1840—A. Denayrowze.
Weaving, printing threads used in—1730—R. A. Brooman.
Woods, staining and graining—1851—J. M. and J. M. Murphy.
Wool, &c., opening and straitening—1865—J. Thornton.

Invention with Complete Specification Filed.

Valves, slide—1893—R. C. Bristol.

Patents Sealed.

274. E. P. Colquhoun and J. P. Ferris.
275. E. P. Colquhoun and J. P. Ferris.
279. J. Sainty.
286. J. Hughes.
287. C. A. Wheeler.
288. A. S. Stocker.
292. C. Lungley.
298. W. Vale.
307. F. Row.
324. W. H. Latham and F. C. W. Latham.
334. H. Masters.
335. C. Henderson.
351. C. Field.
370. A. V. Newton.
376. E. Lord.
396. A. V. Newton.
421. J. von der Poppenburg.
1058. C. F. Cotterill.

From Commissioners of Patents Journal, August 1st.

Patents Sealed.

301. B. L. Mosely.
310. J. A. Phillips.
315. R. A. Brooman.
319. R. M. Alloway.
326. R. Shaw.
328. A. Steven.
363. J. C. C. Halkett.
371. J. Dale.
380. W. E. Newton.
401. R. W. Thomson.
408. E. J. C. Welch.
424. J. Purdey.
425. B. Thompson.
426. B. Thompson.
430. A. V. Newton.
455. J. Brown.
456. J. O. Christian, J. Charlton, and H. Charlton.
466. T. Ogden.
512. W. E. Newton.
1308. J. R. Cooper.

Patents on which the Stamp Duty of £50 has been Paid.

2101. J. Dickson.
2100. J. Leetch and B. Mathew.
2111. J. and H. Redgate.
2130. W. Spence.
2169. J. W. Woodford.
2181. G. A. Biddell.
2126. R. Low and W. Duff.
2141. E. Burnett.
2180. G. Haseltine.
2311. S. A. Bell and T. Higgins.
2338. T. Clements, P. and J. Llewellin & J. W. Jones.
2148. E. T. Hughes.
2297. C. E. Spagnoletti.

Patents on which the Stamp Duty of £100 has been Paid.

1731. W. Hartley.
1724. C. Mather.
1811. W. Smith.

THE

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111TH SESSION.] FRIDAY, AUGUST 11, 1865. [No. 664. VOL. XIII.

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Proceedings of the Society.

MUSICAL EDUCATION COMMITTEE.

The Committee met on June 5th, 1865. Present: HENRY COLE, Esq., C.B., in the chair, Sir Geo. Clerk, Bart., Sir J. Harington, Bart., Sir J. P. Boileau, Bart., Sir. Francis Sandford, and Capt. Donnelly, R.E.

M. OTTO GOLDSCHMIDT was examined by the Committee as follows:—

174. You are one of the Professors of the Royal Academy of Music?—I have been so since Christmas, 1863—about eighteen months.

175. Professor of what?—The pianoforte.

176. Have you had an opportunity of becoming acquainted with the system of management there generally, or is your experience limited to your own classes?—I have become to some extent acquainted with it, because I have the pleasure of knowing, in addition to the Principal, one or two of the directors of the Academy. I have repeatedly had conversations with them on the subject; and this, together with the experience I have gained in the discharge of my own duty, enables me, I believe, to judge of the working of the Academy.

177. You understand that the object of this Committee is the improvement of the Royal Academy of Music, which, like all other institutions, may perhaps be said to be capable of improvement. Have you any objection to state generally your opinion with regard to the Royal Academy of Music, and, as far as your experience has gone, the opinion you have formed with respect to it?—Before offering any opinion perhaps I ought to state that I was for three years a student at Leipsic, at the time when Dr. Mendelssohn Bartholdy was chief director. I also know to some extent the Academy of Vienna, and the academy lately established at Dresden. I am honorary member of the Royal Academy at Stockholm, and I have had some opportunity of observing the working of the Academy at Paris. This comprises the extent of my knowledge of the musical academies abroad.

178. Do you find much difference between those academies and the Royal Academy of Music?—Yes.

179. Broadly speaking, what should you say the differences are?—The difference is in the working chiefly. The Royal Academy is worked, if I may so say, by professors individually; whereas abroad it proceeds from a directorship as its centre, and there is more of one spirit prevading the continental academies than seems to be the case in the Royal Academy. I think there is a want of unity of working.

180. You think there are good reasons for arriving at that opinion, and that probably the cause might be remedied?—In my opinion certainly.

181. Will you favour the committee with your opinions on that subject?—The Royal Academy is not worked by departments with responsible heads. There are many professors. I can hardly tell the number, but I believe there are nominally half as many professors as pupils, say about thirty-six professors to about seventy pupils. The Royal Academy of Music had no grant from the Government until last year, and I hope I shall not give offence in saying that there have been many opposing interests, which the Academy has found it necessary to conciliate, and which, with a position rendered firmer by means of a public grant, it might disregard. All the professors teach independently of each other. I have taught at the Academy eighteen months, and during that time I have had very few opportunities of speaking with the other professors about our pupils and their progress. The professors are paid per lesson, and, no provision at present existing for joint deliberations with regard to their pupils, they cannot engage in such deliberation except at the sacrifice of the hours that should be given to tuition.

182. In point of fact the professors go there simply to give the lessons to the pupils?—Yes; I speak under correction when I add that the only distinction as to their position in the Academy consists in their rate of payment. In other respects we are all on a level. I consider this should be altered.

183. Has there been no board of professors since you have been connected with the Academy?—About the time I entered on my duties the functions of the "board of professors" ceased. The professors have pupils varying considerably in proficiency assigned to them; this hinders the simultaneous instruction of several pupils by the same teacher. It is my opinion that if I had four or five pupils fit to be taught together, they would learn three times as much as if they were taught singly; for, besides being a longer time under instruction, they would also be subject to the additional impulse derived from emulation. At present, in the instrumental classes, each pupil is entitled to two half-hours' instruction on his special instrument (besides other instruction) per week.

184. Are they not all taught in classes?—It is generally understood that the teaching should be in classes; but

in many classes I believe the proficiency is so varied as to render it useless for all the pupils to attend at the same time. When I was at Leipsic, under Dr. Mendelssohn-Bartholdy, there were never less than five or six pupils taught by him at a time, extending over not more than two hours. In correcting one pupil he instructed the others at the same time; but in that case the pupils were pretty much on a par with each other. It was a saving of time and trouble to the professor, and a benefit to the pupils.

192. You have instanced Mendelssohn, who did not object to teach five or six in a class, but who probably would not have taught singly?—Yes; and he had the best students, who felt it, of course, an honour to be under him.

194. Will you favour the Committee with your views with respect to there being too many professors in particular branches of music at the Academy, and the insufficient payment made to them?—With regard to the payment I cannot speak about that, as it is a matter of private arrangement.

195. Are you under the impression that the professors are insufficiently paid?—I am. Having observed that there are too many professors, looking at the number of pupils in each branch, I would explain as follows: I would not restrict the number of head professors to one in each department, because, in a city like this, there is an ample supply of first-rate talent from which two or three head professors might with advantage be selected, but there should not, I think, be so many as, for example, ten or twelve different styles of pianoforte-playing in an academy, as the independent teaching of ten or twelve professors might involve. At present there are eight or ten professors, and some sub-professors, of the pianoforte alone. With the exception of one examination a year, and occasional playing with the orchestra, there are no means of publicly testing, within the Academy, the progress of the pupils. I believe there used to be two examinations in the year, which enabled the authorities to follow much better what the pupils did, and the second examination should be resumed. At present no professor is responsible for what is done beyond his own class. If the Academy were divided into departments, according to the different branches of tuition, there would be in the several departments head professors, responsible for the tuition, although carried out through the medium of subordinate teachers.

198. Do we understand the system you recommend to be this—that there should be two or three head professors—say of the pianoforte?—Yes.

199. That under these head professors there should be a certain number of subordinate professors, who should educate the beginners, with the view of their ultimately going into the classes of one of the head professors. For instance, that A should have a certain number of pupils under him; and the same with B, and so on?—Quite so, with this addition; I would make it imperative upon the head professors to see what their juniors do.

200. And they should be responsible for their subordinates?—Yes; and the head professors responsible to the principal and directors. The head professors should receive an annual stipend in virtue of their office, quite independently of the fee for their lessons, whatever that may be.

201. You see no objection to the head professors appointing the sub-professors?—No; I think it well that they should nominate the sub-professors for whom they are to be responsible, assuming this course to be in other respects convenient, the appointment being subject to the principal.

204. You have said you would recommend heads of the different departments; are you of opinion that there should be a principal over the whole Academy, to whom the head professors should be responsible; or do you think it would be better to reconstruct the board of professors and have no principal?—I think there ought to be a principal.

205. As far as you are acquainted with the foreign conservatoires and academies do you know whether they all have principals?—Cologne and Brussels have one, Vienna also had when I knew it. They are very differently constituted. At Leipsic, during my time, Mendelssohn was virtually the principal, though not appointed as such. There was a board of five directors, of whom Mendelssohn was one.

206. Professional directors?—No; not absolutely professional, but gentlemen for the most part well versed in music. Mendelssohn was one of the founders of the Conservatoire at Leipsic, and during his lifetime he was the leading soul of it. I wish to refer the Committee to several allusions to the Leipsic Conservatoire (as well as that projected for Berlin by the late King of Prussia) contained in the 2nd volume of Mendelssohn's letters, under dates February 13, 1841; November 23, 1842; April 13, 1843; March 6, 1845; as well as the memorandum of May, 1841 (see Appendix, p. 606).

207. It is stated here (referring to a printed report) that none of the directors of the Leipsic Academy are educated musicians, and the president is a retired lawyer; therefore this report bears out the idea that the directors of that Academy are not necessarily professional musicians.—No; the social relations on the continent being very different to those prevailing in this country, the two systems cannot easily be compared. The retired lawyer spoken of was an intimate friend of Mendelssohn's, who, again, was an intimate friend of M. David, the principal violin professor.

208. At the same time you think it desirable that some direction should be exercised by persons having a professional status?—I believe it to be more than desirable—necessary. There should be a principal—a professional man, who can give his chief time and energies to the duties.

209. The best man in fact who could be obtained?—Yes; and unfettered by private engagements.

210. Are you of opinion that the fees are what they ought to be?—I have already stated my impression to be that they are not.

211. What do you consider the principal inducement on the part of professors to connect themselves with the Academy? Is there a *prestige* or distinction attached to the teaching at the Royal Academy? With the younger professors I imagine this would be the case. It might be so with many. With all the professors there would doubtless be the satisfaction of seeing the results of their labours in the ultimate proficiency and distinction of their pupils, which they can hardly expect among their amateur pupils.

212. The question as to the fees was intended rather to apply to those paid by the pupils of the Academy. What is your opinion with regard to the fees required from the students?—I think they are higher than a great many pupils can conveniently pay for their instruction.

213. Do you think the amount of the fees sometimes prevents the acquisition of good pupils by the Academy?—I will not say they prevent the acquisition of good pupils, but they no doubt preclude some from entering the Academy at all; in other cases it may lead to students leaving the Academy prematurely. The fees in many cases, I have do doubt, are provided at considerable sacrifice on the part of parents. I have already, on a previous occasion, expressed the opinion that there should be many more exhibitions connected with the Academy than there are at present. There are now only two whole exhibitions and two partial ones. When the Leipsic Academy was founded, in 1842-43, Mendelssohn appears to have felt—and I believe some importance is attached by this Committee to the example of Leipsic—that it could not be founded without a public grant. (See the letters alluded to.) About that period a Leipsic citizen placed, by bequest, at the King's disposal, the sum of 20,000 dollars, to be devoted to some object of art. Mendelssohn succeeded in obtaining that money for the establishment of the Conservatoire, on condition that

exhibitions should be founded, of which there are at the present moment, I believe, ten, the general fee, nevertheless, amounting to no more than one-third of what it is here.

214. Are you in favour of as many exhibitions as possible, subject to proper regulations?—I think they should be fixed in proportion to the number of paying students, say in the ratio of 20 per cent.

215. Do you think it right that students should pay certain fees, or that the education should be gratuitous, as in Paris?—In this country I think fees should be paid.

216. Do you think thirty-three guineas a year too high; or do you think the fees should be varied according to the circumstances of the students?—My impression is that there should be a senior and a junior department, and the fees of the latter should be lower. This regulation has, I believe, been lately adopted at the Royal Academy.

217. By juniors you mean those of inferior musical qualifications?—I mean, as a rule, the younger students. I have been in most of the towns of importance in England, and, excepting the cathedral towns, I think there is no other country in the provinces in which good musical instruction appears so difficult to obtain. Many students come to the Academy either too late or insufficiently instructed; and if there were a junior department in the Academy, and means could be taken for assuring the parents, as far as practicable, of the proper housing of the students from the provinces, they might come earlier to the Academy, and have a better chance of rising in it. There are some few young pupils, but, with these exceptions, the pupils for the most part are somewhat advanced in years in proportion to their attainments.

218. I see in the Academy prospectus there is a junior department with a fee of seven guineas per term—that is twenty-one guineas a year; does not that appear to be rather high? if the fees were lower they would get more pupils?—Under existing circumstances the instruction received by the pupils cannot be obtained for a lower fee, although I consider it highly desirable that it should be lower.

221. Looking to the class of persons who for the most part attend the Academy, what would you say should be the largest fee they ought to pay?—That is a difficult question to answer at once. I presume all the students coming to the Academy come for professional objects; at least that is what we wish if it is the institution it ought to be.

222. You would wish it to be confined to persons intending to pursue music as a profession?—I assume that to be so.

223. Would you like it so?—I assume it would be confined to such.

224. Do you exact any test of competency before you admit a student, with or without payment of fees?—There is an admission test I think now; nevertheless the Academy, in its present condition, can hardly afford to reject pupils for want of qualification.

225. Will you point out the difference between teaching other arts—drawing, for instance—and teaching music?—In class teaching of music it is necessary that the pupils in each class should be pretty much on a par, or else one less advanced keeps back the others; in drawing it would not necessarily be so.

226. We have heard that there are from ten to twelve teachers of the pianoforte in the Academy, all of them, it is to be presumed, good executants themselves. Is it your opinion that because a person is a good performer he must necessarily be a good teacher of the instrument?—I should not say necessarily so.

227. Should you say a person was competent to give instruction on an instrument of which he was not himself master?—I should say, as a rule, not.

228. But how would it be in the case of singing, where many of the best teachers are not remarkable for their vocal powers?—That is the case with some of the masters of the Academy at the present time; but with regard to instrumental teaching, I consider the teacher ought to be able to play for his pupils all the music that he puts before them.

229. Which foreign institution could, in your opinion, furnish the committee with the most valuable hints as to management?—They would probably each one furnish something that would be useful, but they would require to be adapted to English notions and practices.

230. You mentioned Dresden as a new institution. Do you think that embraces all the recent improvements that have been introduced into the conduct of such institutions?—There are some features in the Conservatoire of Paris which would be the greatest boon to the Royal Academy present or future. One is their excellent band of instrumentalists. The Leipsic Academy is an excellent one. So I understand that of Cologne to be. I belong to the board for awarding the Mendelssohn scholarship in this country, and at a recent election the successful candidate was sent to Leipsic, as the place affording the greatest facilities and stimulus for his further progress.

231. Leipsic was selected in preference to the Royal Academy or any other place?—Yes.

232. You concurred in that individually?—Yes; chiefly on account of the great encouragement given there—the impulse given to the student.

234. Can you direct the Committee to anything worthy of imitation at Vienna?—I do not know it sufficiently of late. My impression is that Paris, Leipsic, and Cologne possess the most thriving conservatoires, and they are ably managed.

236. Do you find the accommodation of the present premises of the Academy all you could wish?—We hear each other in the adjoining rooms, and that is undesirable.

237. You would not object to improved premises?—No; but they should be centrally situated. The present locality, as a centre of the musical portion of London, is a very good one. It may be termed the musical centre of London, being in the neighbourhood of many concert-rooms, and also of the music sellers and instrument makers, not to mention that it is in the neighbourhood of the residences of many of the professors.

238. Looking to your present acquaintance with the musical status of England, do you think it would be in your power to submit to the committee hereafter a plan for the payment of the professors, fees for pupils, and for the extra exhibitions which you would recommend?—Personally I should have no objection to do so; but I do not think it would do any good, and might appear presumptuous on my part.

239. Of what improvements do you consider the system of the Royal Academy of Music susceptible?—I answer—individual opinions and suggestions have been offered before, and the musical world has seemed so divided that no practical good has resulted from those individual plans. My plans would share the fate of those which have gone before.

240. It would help the committee in the consideration of the subject.—I believe I could give my own notion in very few words now.

241. That is assuming adequate funds are forthcoming for the purpose of the Academy?—I would have the tuition of the Royal Academy comprise singing, string instruments, the pianoforte and organ, and wind instruments, harmony, counterpoint, composition, and such further knowledge of the art and history of music as may justly be expected from an institution of this stamp. The tuition should also include the study of church and cathedral music, not to compete with special cathedral education, but as an essential part of a complete musical education. Again, the Academy ought to have a fair instrumental band as an indispensable means of instruction.

242. You mean independently of the students?—If there are not sufficient instrumentalists amongst the students, the orchestra should be supplemented by paid musicians.

243. Is that the case in Paris?—The orchestra of the Conservatoire of Paris is avowedly most efficient. But to return to the Royal Academy. The students being taught composition, and being encouraged to produce specimens of their own proficiency, should be provided with the means of having them decently performed. Further, there should be a proper musical library. Encouragement and stimulus should be given to the pupils by instituting additional exhibitions to be competed for, as well as minor prizes. I would further suggest, as the highest prize, one or two scholarships, to be awarded for not less than two years, to students on leaving the institution, as available either for the purposes of travel or otherwise with a view to further cultivation of the art, free from the necessity of its exercise for self-support.

244. You would leave the professional instruction solely in the hands of professional people?—Yes; certainly; in fact that is indispensable.

245. Would you approve of lay committees and directors?—As a rule. In my opinion a directorship of laymen works very well, and would prove a support to the principal. For the rest I believe that in the earlier part of my evidence, referring to principal, head professors, sub-professors, &c., I have sufficiently indicated the organism by which the plan thus sketched should be worked. And now I wish to add a few words with reference to the status of the Royal Academy. It has been much attacked, and in my opinion its faults have been a good deal exaggerated. My own impression is that, though of late years it may have been at a rather low ebb, the present directors and all connected with it are doing their best to raise and improve it, and that there is decidedly an upward movement. Whatever the faults of the Royal Academy may be, and I have no doubt it has some, I am certain that, with alterations of the nature already described, it would command the confidence of the country in a greater degree than could be expected of any new institution. I have found by personal experience the best professors of music in the large towns to have been students of the Royal Academy. The main object of the Institution, as I apprehend it, is not so much to produce individual instances of conspicuous attainment as a comparatively numerous body of well-instructed and competent musicians. In this the Royal Academy has hitherto been to a considerable extent successful, and I am not aware of any other institution of the kind in this country of which so much can be said. A list has been prepared (which is given below) comprising many of the principal towns of the United Kingdom, in which, as already mentioned, the chief professional musicians are known to have been students of the Royal Academy; and while, with regard to them, it may fairly be presumed that they entertain a kindly feeling to the Institution where they have pursued their studies, it is obvious that, with the developed efficiency which an amended organisation would secure, the Academy would rise in their opinion, and, thus strengthened by their increased support, would command the confidence of the country at large.

APPENDIX.

List of former Students of the Royal Academy of Music, now established in the Country as Professors:—

Aberdeen—W. Adlington, pianoforte and vocalist; R. Latter, vocalist and pianoforte; R. H. Baker, pianoforte, and org. St. Andrew's.

Bath—J. K. Pyne, vocalist, pianoforte, org. the Abbey.

Belper—C. Batchelor, pianoforte.

Birkenhead—E. Gunton, pianoforte, org. St. John's; S. Percival, pianoforte.

Birmingham—Mrs. Baker, vocalist and pianoforte.

Blackheath—W. Latter, pianoforte.

Bradford—J. Burton, pianoforte; Miss Freeman, pianoforte and vocalist.

Brighton—C. Goodban, Mus. Bac., pianoforte.

Bristol—Miss Pillinger, vocalist and pianoforte.

Bury St. Edmunds—J. Reeve, pianoforte.

Cardiff—J. Wilkes, pianoforte.

Cheltenham—M. Von Holst, pianoforte and vocalist.

Chester—A. Sapio, vocalist and pianoforte.

Deal—J. Harrison, pianoforte.

Dewsbury—T. Burton, pianoforte.

Dublin—F. Hoffman, pianoforte.

Exeter—W. Baly, pianoforte, org. St. Leonard's.

Glasgow—A. C. Johnson, pianoforte; J. Thomson, pianoforte, org. Glasgow Cathedral.

Gloucester—T. Goodfellow, pianoforte, org. Philharmonic Society; A. W Wheeler, pianoforte.

Greenwich—Miss La Feuillard, pianoforte and harp.

Hanley—T. Chantery, pianoforte.

Harrow-on-the-Hill—J. B. Turner, pianoforte.

Hillsboro' (Belfast)—Mrs. E. B. Harper, pianoforte and vocalist.

Heversham—R. T. Wilson, pianoforte.

Isle of Man—J. Barber, pianoforte; H. Canan, pianoforte (bandmaster); D. Reeve, pianoforte.

Isle of Wight—S. Shaw, pianoforte (Ryde).

Ipswich—R. L. Nunn, pianoforte.

Leeds—J. W. Pew, pianoforte; J. W. Sykes, pianoforte.

Leicester—Miss Deacon, vocalist and pianoforte.

Liverpool—B. R. Isaac, pianoforte; S. Percival, pianoforte; W. Streather, pianoforte; E. W. Thomas, pianoforte and violin; C. J. Toms, harp and pianoforte.

Macclesfield—Miss H. Condron, vocalist and pianoforte; G. Gee, pianoforte.

Manchester—C. Bloxsome, vocalist and pianoforte; C. A. Seymour, pianoforte and violin; J. Wrigley, pianoforte.

Marlboro'—W. S. Bambridge, pianoforte, org. College.

Newcastle-on-Tyne—Miss Larbalestier, vocalist and pianoforte.

Newcastle-under-Lyne—T. Mason, pianoforte.

Northampton—C. McKorkell, pianoforte and org. All Saints; Miss McKorkell, harp and pianoforte; G. Packer, pianoforte.

Penzance—J. H. Nunn, pianoforte.

Pershore—Miss Tovey, vocalist and pianoforte.

Plymouth—F. Burford, pianoforte; T. E. Weekes, pianoforte; S. Weekes, pianoforte.

Poole (Dorset)—Miss Churchill, pianoforte and vocalist.

Ramsgate—Miss F. Martin, pianoforte.

Salisbury—Miss L. Aylward, vocalist and pianoforte; C. J. Read, pianoforte.

Shrewsbury—Walter Hay, pianoforte.

Southwell (Notts)—J. C. Stone, pianoforte.

Southsea—C. J. Mew, pianoforte.

Taunton—J. Pridham, pianoforte and vocalist.

Torquay—T. Brooks, pianoforte; C. Fowler, pianoforte.

Weston-super-Mare—W. H. Palmer, pianoforte.

Wimborne—J. W. Smith, pianoforte and org. Minster.

Windsor—Miss Kellner, vocalist and pianoforte.

Wolverhampton—G. Wheeldon, pianoforte.

Woolwich—Miss Whomes, pianoforte and vocalist.

Worcester—Miss D'Egville, vocalist and pianoforte; R. Mason, pianoforte.

York—E. White, pianoforte.

Letters from Mendelssohn Referred to in Answer No. 206.

To Paul Mendelssohn Bartholdy.

Leipzig, February 13th, 1841.

The Berlin affair is much in my thoughts, and is a subject for serious consideration. I doubt whether it will ever lead to that result which we both (I believe)

would prefer; for I still have misgivings as to Berlin being a soil where a person of my profession could feel even tolerably at home, in spite of all honours and money, but the mere offer in itself gives me an inward impulse, a certain satisfaction, which is of infinite value to me, even if I were never to speak of it to any one; in a word, I feel that an honour has been done me, and I rejoice in it. Massow writes in his last letter, which I received before yours, that the King wishes to delay the definite arrangements of the Academy till I go to Berlin in spring; whether I choose to make proposals in writing as to the alterations of the statutes which he sends me, he leaves entirely to my own decision. As the point is left to myself, and I would far rather not write at all on the subject, I shall delay doing so till I know to a certainty whether I go to Berlin in spring or not, and only in the latter case write. Remarkable, very remarkable, these statutes are, especially those of the school for composition. Imagine! out of eleven different branches of instruction which they have instituted, seven are positively useless, and indeed preposterous. What do you think of the following, among others? No. 8. "The relation Music bears to the other arts, especially to the plastic and to the stage;" and also No. 11, "A guide to the spiritual and worldly Drama." I formerly read these things in the Government paper, and laughed at them; but when a grave minister or official actually sends such stuff, it is pitiable. Pray do go to some public place where newspapers are collected, and send me the one which advertises this course, and where the teachers of the different branches are named. I require these data thoroughly to understand the affair. It is all in the worst possible state; you will say this is the very reason why I should try to extricate it. In that case there would indeed be plenty to do, if I could only think myself the man to do it; to improve what is already good, or to create what is new and good, would be an undertaking that I should rejoice in, and which might be learned, even if there were no previous knowledge of the subject; but to change what is positively bad into better things, is both a hard and a thankless task.

To Carl Klingemann, London.

Leipzig, Nov. 23rd, 1842.

* * * The following are the plans which the King detailed at full length; first of all, to form a kind of real *capelle*, that is, a select choir of about thirty very first-rate singers, and a small orchestra (to consist of the *élite* of the theatrical orchestra); their duties to consist in church music on Sundays and at festivals, and besides this, in performing oratorios and so forth; that I was to direct these, and to compose music for them, &c., &c. "Certainly," said I, "if this had ever been mentioned, if it could only be accomplished; this being the very point at issue which I had found wanting." On which he replied again, that he knew perfectly well I must have an instrument to make music on, and that it should be his care to procure such an instrument of singers and players; but when he had procured it, he must know that I was prepared to play on it; till then I might do as I liked, return to Leipzig, or go to Italy—in short, be entirely unfettered; but he must have the certainty that he might depend on me when he required me, and this could only be ensured by my remaining in his service. Such was at least the essential substance of the whole long conversation; we then separated. * * * * I went to Dresden a few days after my return, thanked the King once more, and entreated him not the less to bestow the twenty thousand thalers (which an old Leipziger left in his will at the disposition of the King for an Academy of Art) to found a school for music in Leipzig, to which he graciously acceded. The official announcement came the day before yesterday. The music school is to be organised this very winter, at least in its chief features; when it is established, I may well say that I have been the means of procuring a durable benefit for music here.

To I. Moscheles, London.

Leipzig, April 13th, 1843.

* * * Our Music Academy here has made a famous beginning; fresh notices of students arrive almost daily, and the number of teachers, as well as of lessons, have been necessarily very much increased.

Two serious maladies, however, are apparent, which I mean vigorously to resist with might and main so long as I am here: the direction is disposed to increase and generalise,—that is, to build houses, to hire localities of several stories,—whereas, I maintain that for the first ten years, the two rooms we have, in which simultaneous instruction can be given, are sufficient. Then all the scholars wish to compose and to theorise, while it is my belief that vigorous practical work, thorough steady practising, and strict time, a solid knowledge of all solid works, &c., &c., are the chief things which can and must be taught. From these, all other knowledge follows as a thing of course, and anything further is not the affair of learning, but the gift of God. I need not however, I am sure, say that notwithstanding this, I am far from wishing to render Art a mere handicraft.

To Minister Eichhorn, Berlin.

Frankfort-on-the-Maine, March 6th, 1845.

I must first of all thank your Excellency for the flattering proof of confidence contained in the letter I have received from your Excellency, and also for your wish to hear my opinion in so important a matter. That the reform of the Academy of Arts and its musical section, which your Excellency refers to in your letter, will be of the greatest value to the whole musical condition of Berlin, does not admit of the smallest doubt. Your Excellency informs me that it is your intention to effect this by placing a composer at the head of the musical section, to be a guiding star to the pupils by his own energetic creative powers, like the master of the *atelier* in the plastic arts, and you do me honour to mention my name on this occasion, or in the event of my being prevented accepting this offer, you commission me to point out one of my colleagues in art whom I consider best suited for such a situation. But in order to form a decided opinion on the matter, I must beg for an explanation of various points which, in this and every other affair of the same kind, appear to me the most important, and before which all personal questions must meanwhile retire into the background.

Is the reform which you have in view in the musical section, to consist solely in the appointment of such a composer, and the musical section to continue in the same shape as formerly? If this be the case, what relation will such a director assume to the former members of the senate or section, and to the director of the whole Academy? Is the distribution of the different branches of instruction to remain the same, or is a reform proposed in this respect also? In what precisely does the practical efficacy of such a teacher consist? It is not possible to show the act of composition, as the master in an *atelier* does the design of a picture or the form of a model, and according to your Excellency's words, an intellectual influence is what is chiefly required. Such an influence, according to my conviction, is however only to be obtained in the School of Art, when the whole course of instruction has already laid a sound foundation, when all the teachers in their positive departments strive towards the same point, when no actual deficiency is anywhere overlooked in education, and finally, when, as a key-stone, all the corresponding impulses of this teaching are at once combined and placed before the scholars in their practical application, and thus more strongly impressed on their minds. In this sense I could well imagine such a new active situation

fruitful for good and for influence; but it seems to me that for this purpose it is not merely the situation itself which is to effect it, but in reality a reform of the whole inner constitution of the Academy; and I do not know whether this enters into your Excellency's views, or indeed be within the range of possibility. Without this, the position, though undoubtedly highly honourable, would be devoid of all real, practical utility; a merely general excitement, however great, can at best only call forth an unfruitful enthusiasm in the minds of the scholars, if indeed it calls forth anything whatsoever. The teachers of positive subjects alone would, in such a case, acquire a real and decided influence on the development of young artists; the professor at the head, influencing only by example, would, on the other hand, be like a mere airy phantom, and the connection between the head and the limbs fail, without which neither the head nor the limbs can live or thrive.

If your Excellency will be so good as to give me some more precise information on this matter, I shall then be in a position to form a clearer view of the affair itself, as well as of the personal questions connected with it; and I shall esteem it my duty, on this as on every other subject, to state my opinion candidly to your Excellency.*

Memorandum by Mendelssohn, on the subject of a Music Academy to be established at Berlin.

Berlin, May, 1841.

It is proposed to establish a German Music Academy in Berlin, to concentrate in one common focus the now isolated efforts in the sphere of instruction in art, in order to guide rising artists in a solid and earnest direction, thus imparting to the musical sense of the nation a new and more energetic impetus; for this purpose, on the one side, the already existing institutes and their members must be concentrated, and on the other, the aid of new ones must be called in.

Among the former may be reckoned the various Royal academies for musical instruction, which must be united with this musical Academy, and carried on as branches of the same, with greater or less modifications, in one sense and in one direction. In these are included, for example, the Institute for Elèves of the Royal Orchestra; the Organ Institute; that of the Theatre (limited to the theatre alone) for instruction in singing, declamation, &c. Further the members of the Royal *Capelle* must be required to give instruction on their various instruments. A suitable locality can no doubt be found among the Royal buildings, and also a library, with the requisite old and new musical works, scores, and books.

The new appointments to consist of—

1. A head teacher of composition; the best that can be found in Germany, to give regular instruction in theory, thorough-bass, counterpoint, and fugues.
2. A head teacher of solo singing; also the best to be had in Germany.
3. A head teacher of choral singing, who should strive, by his personal instructions, that the scholars under his care should be distinguished by good pianoforte playing and steady direction.
4. A head teacher of pianoforte-playing, for which office a man of the most unquestionable talent and reputation alone must be selected. The other teachers for these departments could be found in Berlin itself; nor would there be any difficulty in procuring teachers of æsthetics, the history of music, &c.

The complete course to last three years; the scholars, after previous examination, to be instructed gratis; no prize works to be admitted; but at stated periods all the works of the scholars, from the time of their admission, to be collected and criticized in connection with each other, and subsequently a prize (probably consisting of a sum sufficient for a long journey through Germany, Italy, France, and England) to be adjudged accordingly. Every winter a certain number of concerts to take place, in which all the teachers (including the above-named members of the Royal *Capelle*) must co-operate, and by which, through the selection of the music, as well as by its execution, direct influence may be gained over the public at large.

The following principle might serve as a basis for the whole Institute: that every sphere of art can only elevate itself above a mere handicraft, by being devoted to the expression of lofty thought, along with the utmost possible technical finish, and by a pure and intellectual aim; that consequently solidity, precision, and strict discipline in teaching and learning, should be considered the first law, thus not falling short in this respect of any handicraft; but that at the same time, in every department, all teaching and learning should be exclusively devoted to the expression of the aforesaid thoughts, and to that more elevated mood to which technical perfection in art must ever be subordinate.

* This communication led to no results.

EXAMINATION PAPERS, 1865.

(*Continued from page* 595.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

ENGLISH LITERATURE.

THREE HOURS ALLOWED FOR THE TWO AUTHORS SELECTED BY THE CANDIDATE.

SHAKSPEARE.

(MACBETH.—HENRY V.—THE TEMPEST.)

I.

1. State the connexion in which each of the following passages occurs, explain every allusion, and notice the unusual words and grammatical constructions:—

(*a*) The sin upon my head, dread Sovereign!
For in the book of Numbers is it writ—
When the man dies, let the inheritance
Descend unto the daughter.

(*b*) The sin of my ingratitude even now
Was heavy on me: thou art so far before,
That swiftest wing of recompense is slow
To overtake thee. 'Would thou hadst less deserv'd;
That the proportion both of thanks and payment
Might have been mine! only I have left to say,
More is thy due than more than all can pay.

(*c*) The slave, a member of the country's peace,
Enjoys it; but in gross brain little wots
What watch the king keeps to maintain the peace,
Whose hours the peasant best advantages.

(*d*) ———Sitting on a bank,
Weeping again the king my father's wrack,
This music crept by me upon the waters.

(*e*) ———More will I do,
Though all that I can do is nothing worth,
Since that my penitence comes after all,
Imploring pardon.

(*f*) You are three men of sin, whom destiny
(That hath to instrument this lower world,
And what is in it) the never-surfeited sea,
Hath caused to belch up you, and on this island
Where man doth not inhabit.

(*g*) ———Now does he feel
His secret murthers sticking on his hands;
Now minutely revolts upbraid his faith-breach;
Those he commands move only in command,
Nothing in love; now does he feel his title
Hang loose about him, like a giant's robe
Upon a dwarfish thief.

2. Turn the passages *a* and *b* into plain prose.

3. Explain the expressions—"the shales and husks of men"—"the Mediterranean flote"—"the law Salique"—"kernes and gallow-glasses"—"the still-vexed Bermoothes."

4. Give some account of the Chorus in Henry V.

II.

1. Briefly sketch the plot of the first act of Henry V., or of the third act of Macbeth.

2. From what historical sources did Shakspeare take the plots of Henry V. and Macbeth? In what particulars has he deviated from historical authority?

3. What do you know of the sources of the text of these three plays?

4. Give some account of Shakspeare's life while he resided in London.

Reed.

Introduction to English Literature.

1. Which are the peculiar advantages of the English language compared with most other languages? Why are native Saxon words to be generally preferred to words of foreign origin?

2. Give some account of the process by which the English language has been formed.

3. Explain the distinction between *shall* and *will.*

4. "If Chaucer was unfortunate in the period of his country's language, he was happy in the era of his country's history." Explain this statement. Sketch the plan of the Canterbury Tales.

5. What place in the history of English prose literature does Mr. Reed assign to Richard Hooker? What do you know of Hooker's great work?

6. Give some account of Comus, or of Lycidas.

7. Express briefly the substance of Mr. Reed's remarks on Sunday reading. What are his objections to the Paradise Lost? Do you agree with them?

8. Name the great essayists of the time of Queen Anne, with their principal works. Give some account of the *Spectator*.

9. What was the effect of the French Revolution, and of the causes which led to it, upon literature, and upon English literature in particular?

10 What is the predominating tendency of the poetry of Wordsworth? What do you know of "The Excursion?"

11. What English authors have shown the faculties of Wit and Humour to the greatest advantage? What are the chief abuses to which those faculties are liable?

12. What are the characteristics of a true letter? Who are the best writers of letters in our language? What are the chief faults in Pope's letters?

Butler.

The Analogy.

I.

1. How is probable evidence distinguished from demonstrative evidence? How does Butler illustrate the distinction?

2. "Nor can we find anything throughout the whole analogy of nature to afford us even the slightest presumption that animals ever lose their living powers." Briefly sketch the train of reasoning into which these words are introduced.

3. What are *final causes?* In what way may the existence of an intelligent Governor of the world be proved from them?

4. How does Butler refute the notion that "things may be now going on throughout the universe, and may go on hereafter, in the same mixed way as here at present upon earth—virtue sometimes prosperous, sometimes depressed; vice sometimes punished, sometimes successful?"

5. Explain the distinction between *passive habits* and *active habits*. In what way does this subject bear upon the line of argument?

6. In what sense does Butler say we are to understand "that general assertion, that the opinion of necessity is essentially distinctive of all religion?"

7. By what arguments is the objection to Christianity met, that it has done but little to improve the world?

8. State the distinction between moral precepts and positive precepts, and give examples.

9. Which are the main arguments on which Butler founds the credibility of a revealed religion?

II.

1. Sum up, as briefly as you can, the author's purpose in the first part of the Analogy.

2. Which are the main objections that have been urged against arguing from the analogy of Nature to Religion? In what way may they be answered?

3. Give some account of Bishop Butler. Name his other works besides the Analogy.

Milton.

Paradise Lost.—Book I.—VI.

I.

1. In what connexion does each of the following passages occur? Explain every allusion, and notice any unusual words or grammatical constructions which occur in them:—

(*a*) ———Not that fair field
Of Enna, where Proserpine gathering flowers,
Herself a fairer flower, by gloomy Dis
Was gathered, which cost Ceres all that pain
To seek her through the world.

(*b*) ———As when by night the glass
Of Galileo, less assured, observes
Imagined lands and regions in the moon:
Or pilot, from amidst the Cyclades,
Delos or Samos first appearing, kens
A cloudy spot.

(*c*) This inaccessible high strength, the seat
Of Deity supreme, us dispossessed,
He trusted to have seized.

(*d*) O, for that warning voice, which he who saw
The Apocalypse heard cry in heaven aloud;
Then when the dragon, put to second rout,
Came furious down to be revenged on men,
"Woe to the inhabitants on earth!"

(*e*) High on a throne of royal state, which far
Outshone the wealth of Ormus and of Ind,
Or where the gorgeous East with richest hand
Showers on her kings barbaric pearl and gold,
Satan exalted sat——

(*f*) ———Anon they move,
In perfect phalanx, to the Dorian mood
Of flutes and soft recorders.

2. Give a short account of Satan's passage from hell to the earth.

3. Servant of God, well done; well hast thou fought
The better fight, who single hast maintain'd
Against revolted multitudes the cause
Of truth: in word mightier than they in arms;
And for the testimony of truth hast borne
Universal reproach, far worse to bear
Than violence; for this was all thy care,
To stand approved in sight of God, though worlds
Judged thee perverse: the easier conquest now
Remains thee, aided by this host of friends,
Back on thy foes more glorious to return,
Than scorn'd thou didst depart.

(a) Give the sense of this passage in plain prose, adding as little as possible to the number of words.
(b) To whom is it addressed, and on what occasion?
(c) Notice any unusual expressions contained in it.

4. Briefly sketch the substance of Satan's address to the sun, or of Milton's address to light.

II.

1. What personal allusions to the poet himself, or his contemporaries, occur in the Paradise Lost?

2. Give some account of Milton's life, and especially of the circumstances under which the Paradise Lost was written.

3. What do you know of Milton's prose works?

(*To be continued.*)

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1865.

The thirty-fifth meeting will commence in Birmingham, on Wednesday, the 6th of September next, under the presidency of John Phillips, Esq., M.A., LL.D., F.R.S., F.G.S., Professor of Geology in the University of Oxford. The general secretaries are William Hopkins, Esq., M.A., LL.D., F.R.S., St. Peter's College, Cambridge, and Francis Galton, Esq , M.A., F.R.S., F.G.S., 42, Rutland-gate, Knightsbridge, London; the assistant-general secretary is George Griffiths, Esq., M.A., Professor of Experimental Philosophy in the University of Oxford, 5, Park-villas, Oxford; the local secretaries for the meeting at Birmingham are William Mathews, Esq., jun., F.G.S., John Henry Chamberlain, Esq., and the Rev. G. D. Boyle, M.A., Christ Church-buildings, Birmingham; and the local treasurer is William Holliday, Esq.

The following are the arrangements:—

The General Committee will meet on Wednesday, the 6th of September, at one p.m., for the election of sectional officers, and the despatch of business usually brought before that body. On this occasion there will be presented the report of the Council, embodying their proceedings during the past year. The General Committee will meet afterwards by adjournment.

The first general meeting will be held on Wednesday, the 6th of September, at eight p.m., when the President will deliver an address; the concluding meeting on Wednesday, the 13th of September, at three p.m., when the Association will be adjourned to its next place of meeting.

At two evening meetings, which will take place at eight p.m., discourses on certain branches of science will be delivered.

There will also be other evening meetings, at which opportunity will be afforded for general conversation among the members.

The committees of sections will meet daily, from Thursday, the 7th of September, to Wednesday, the 13th of September inclusive, at 10 a.m. precisely.

The sections will meet daily, from Thursday, the 7th of September, to Tuesday, the 12th of September inclusive, at 11 a.m. precisely.

Reports on the progress of science, and of researches entrusted to individuals and committees, and other communications intended for presentation to the sections, are expected to be forwarded in letters addressed to the Assistant-General Secretary, at Birmingham, previous to the meeting, accompanied by a statement whether the author will be present, and on what day, so that the business of the sections may be satisfactorily arranged.

The reports complete, and concise abstracts of other communications, are to be delivered to the secretaries of the sections before which they are read, previously to the close of the meeting, for publication in the Transactions.

The following are the titles of the sections to which communications may be presented:—

Section A. Mathematics and physics.
Section B. Chemistry and mineralogy, including their applications to agriculture and the arts.
,, C. Geology.
,, D. Zoology and botany, including physiology. Sub-section D.
,, E. Geography and ethnology.
,, F. Economic science and statistics.
,, G. Mechanical science.

Until September 2nd, life members who intend to be present at the meeting may receive their tickets by applying to the general treasurer, and returning to him their life member's invitation circular; annual subscribers, who wish to receive their tickets, must return their invitation circular, with £1 enclosed, to the general treasurer, W. Spottiswoode, Esq., 50, Grosvenor-place, London, S.W.

The executive committee at Birmingham will elect new members and associates, on the usual conditions.

Gentlemen who have in any former year been admitted members of the Association, may, on this occasion, renew their membership, without being called upon for arrears, on payment of £1.

After September 2nd, personal application for tickets must be made at the reception-room, Birmingham, which will be opened on Monday, September 4th.

ANGLO-FRENCH WORKING CLASSES EXHIBITION.

This Exhibition, in support of which it will be remembered that a meeting was held in the Society's room some months since, presided over by Mr. W. Hawes, Chairman of the Council, was opened on Monday last, the 7th inst., at the Crystal Palace.

Mr. Herbert Maudslay, of the firm of Maudslay and Field, having taken the chair, the ceremony of opening the Exhibition was commenced with prayer, the Rev. Dr. J. A. Emerton officiating.

The secretary, Mr. R. Coningsby, read a letter from Mrs. Cobden, expressing her regret at being unable to accept the invitation to attend the opening, and saying that had her husband been living, "he would have given his earnest sympathy and support to an exhibition designed to promote the cause—always so dear to his heart—of international peace and goodwill, and so honourable to the men by whom it was originated, and by whom it is being carried out." Mr. Coningsby said that the present Exhibition was an experiment, and that next year he hoped not only that the scheme as it at present stands would be enlarged, but that it would extend itself to an Anglo-French-American Exhibition. One of the French secretaries, M. Edmond Potonié, editor of *L'Association*, rose, and said that while he was obliged to speak French that day to an English audience, he hoped that an Englishman would soon be talking to a French audience on the same subject; and more, that a world-wide extension of their ideas might set many nations talking to one another. He bore earnest and eloquent testimony to the heartiness with which the proposal of this Exhibition had been received by the workmen of Paris. Other speakers followers M. Potonié, and among them M. Tallandier. When all the addresses had been delivered, the Exhibition was declared by the chairman to be open, and the band of the Crystal Palace Company played "God save the Queen."

The display occupies one of the galleries of the nave, approached by the stairs on the north of the Handel Orchestra. It is not yet complete, several important contributions being expected from Paris, and a second and enlarged edition of the catalogues being promised. At present there are the names of fifty-three French exhibitors, thirty-five of whom are Parisian, and not all of those belonging to the artisan class pure and simple. The total number of visitors to the Palace on this occasion was 12,370.

ROYAL SCOTTISH SOCIETY OF ARTS.

The following is an abstract of a paper entitled, "Suggestions for extending the use of the Mariner's Compass, so as to take more complete advantage of its powers, and thereby increase the safety of life and property at sea," read before the above society on the 10th July, by Mr. Neil Stewart.

The aim of Mr. Stewart's suggestions is to show that the safety of life and property at sea would be increased by every seaman having from the Board of Trade, or other competent authority, a certificate of the state of his vision at different stages of his life, which would show his competency for particular duties. One instance is shown of a steersman whose shortness of sight rendered him unfit for his duty, and Mr. Stewart thinks that collisions at sea and shipwreck in foggy weather may not unfrequently arise from defective vision on the part of seamen, as there are men of all grades who disincline to wear spectacles when they first require them, and as sailing in the teeth of the wind, as steamers frequently do, is calculated to impair the sight of seamen rapidly.

That every binnacle should be furnished with lenses, capable of showing the minutest pointing of the compass, for the speed now attained by steamships, with a very slight inaccuracy in steering, might, in a few hours' sailing, carry a ship as many miles out of her course as brought the *Anglo-Saxon* to destruction on Cape Race. Then, in order to make sure that every ship-captain would be made aware of the state of his ship's compass after the stowage of the cargo, and that passengers, shippers, and the public generally would feel assured that life and property would be duly protected against the mis-directed zeal of contending interests, Mr. Stewart suggests that the pilot should be accompanied by an assistant or junior pilot, capable of reading the compass accurately, so that, while the senior pilot would, during the ship's departure, lay her accurately upon certain definite courses, taking the line of the wharf as the first, the junior pilot, furnished with schedules of departure on which the pilot's courses would be printed, would note the marking of the ship's compass abreast of the true courses, so that any difference betwixt them would be seen at a glance. Then of this schedule the junior pilot would fill up a duplicate, so that before leaving the ship the pilot would put his signature to one of the schedules and present it to the chief officer on board, who would sign the other, which the pilot would bring ashore for after reference should that be required.

After the foregoing precautions had been taken, however, a ship might encounter severe weather, and suffer such injury as might make reliance upon the compass doubtful. Against such a case Mr. Stewart suggests the following plan for testing the compass at sea:—Two water-buckets should be filled and suspended from the head or stern of the ship, as widely apart as possible, clear of the water, clear of the ship, and at right angles to her middle line. Then two boats (if convenient, but one might do) should leave the ship in opposite directions, and take positions where the two buckets would appear as one. Each boat should be supplied with a compass, over and across which a small brass rod had been elevated, having in its upper side a groove from end to end. The man in charge of the compass would raise the instrument to his eye, and looking along the groove in the brass rod, order the adjustment of the boat's position until the two buckets seen as one would seem to hang into the groove. Then would be the moment for a signal from one or other, or both boats, that the marking of the ship's compass might be noted along with that in either of the boats, when the difference, if any, would be seen. This experiment repeated with the ship in other positions would assure the captain of the state of his compass, when he would be able to prosecute the remainder of his voyage in comparative safety.

Fine Arts.

French Academy.—The Paris Academy of Fine Arts has elected M. Cavelier, the sculptor, to fill the chair left vacant by the death of M. Duret. The new member of the Academy is a very eminent artist; one of his most extensively known works is a seated figure of Penelope sleeping, which has been reproduced in bronze, and largely circulated; the original is the property of the Duc de Luynes, which is at Dampierre. The statue of Blaize Pascal, in the arcade of the Tour Saint Jacques, near the Hôtel de Ville, is also the work of M. Cavalier.

Academy of Arts, Lyons.—This Academy, in order to arouse the patriotism of its citizens and to encourage art, had offered a gold medal of the value of £60 for the best history of painting, sculpture, architecture, and engraving in Lyons, from the *renaissance* to the present day. The manuscripts are to be sent in before the end of next year.

Art Copyright in France.—The laws of France, and the spirit in which they have been administered, especially during the last few years, are highly favourable to rights of property in works of arts; and, at the same time the infringements of those laws are more frequent than would be expected under the circumstances. The case of a complaint brought by M. Salvatore Marchi, of Paris, a producer of statuettes and other art objects, against M. Laurent d'Alfonso, of Bordeaux, a dealer in such works, offers some points of interest. It appeared that the defendant had purchased pirated copies of the plaintiff's productions, and that some of them had been seized in his possession. The defendant was not proved to have been the producer of the illicit copies, and the court of Reole acquitted him, but ordered the confiscation of the copies seized. M. Marchi appealed to the Imperial Court of Bordeaux, which reversed the decision of the lower court. It was decreed that the defendant, by his knowledge of the class of works referred to—religious art—in consequence of former dealings with the appellant, and, probably, by the receipt of catalogues and lists published by the latter, could not be ignorant of the fact that the images which he had sold in large quantities to the dealers of Verdelais were illicit copies of the appellant's productions; and the fineness of their execution must have told him that they could not have been the work of the Italian modellers, of whom he declared he had purchased them, but must have been produced by more able hands; the Imperial Court, therefore, declared him to have been guilty of selling and offering for sale pirated works, to the injury of the appellant, and condemned him to pay a fine of 200f., 500f. damages, and all expenses.

Manufactures.

The "Field" Boiler.—This boiler consists of a vertical cylindrical steam and water space, having a circular flue passing up through its centre, and numerous water tubes passing from its lower plate into the furnace, which is surrounded by a water casing. These tubes are closed at their lower ends, but open at top to the main body of the boiler. Within them are freely suspended other tubes, of smaller diameter, open at both ends, and extending somewhat above the upper extremities, but not quite to the lower ends, of the outer tubes, the tops of the inner or circulating tubes being fitted with suitable deflectors, for preventing the interference of the ascending with the descending currents. On the fire being lighted, the gravity of the water in the annular spaces between the inner and the outer tubes becoming less than that of the water in the central tubes, rises towards the main body of the boiler, cooler water simultaneously descending the inner tubes to supply its place. The rapidity of circulation increases in direct proportion to the heat to which the tubes are submitted, the consequence being that, how-

ever intense the heat in the furnace may be, it is nevertheless fully absorbed by the water in the boiler, the temperature in the chimney rarely exceeding from 650 to 700 degrees. To prevent heat going direct up the central flue, instead of first passing among the tubes, and being properly absorbed, a cast-iron baffle is suspended over the centre of the fire, just below the entrance to the flue, so that the flame is deflected and compelled to pass among the tubes before entering the chimney. These boilers are said to be very effective, while the saving in space, as compared with Cornish boilers of equal power, is considerable.

Gas from Refuse of Apples.—The *Nouvelliste* of Rouen announces that a great problem has been solved with respect to cheap lighting, Messieurs Gouverneur, De Butter, and Eichelbremer, of Nogent-le-Rotrou, in the department of the Eure-et-Loire, having discovered a means of obtaining gas from the refuse of apples and pears, after the making of cider and perry, with the aid of very inexpensive apparatus, that is to say, with a portable furnace and still head, a second piece, which performs the functions of condenser, washer, and purifier of the gas, and a gasometer. Each charge yields five hundred litres, or half a cubic mètre of gas, or at the rate of a hundred and seventy mètres per ton of the refuse. The heat required for the distillation is said to be 200° centigrade, or just one-sixth of that required for coals. The advantages claimed for the gas are, that it does not contain sulphur, burns without any odour, has no effect on paint or gilt work, and possesses more illuminating power than coal gas. It is said that several manufacturers in the Eure-et-Loire have already availed themselves of the invention, and that the farmers are delighted with the prospects of converting the apple and pear trash, a most unpleasant and hitherto useless refuse, into gas or money. The invention, if successful as stated, will doubtless be turned to account.

Commerce.

Commerce of France.—The returns published for the first half of the current year show an increase in the total amount of imports, the figures being equal to £50,446,440 for 1865, against £47,296,600 in 1864, and £47,300,800 in 1863. Cotton represents £7,508,320; silk, £4,326,640. The exports for the half-year are equal to £55,316,160, being £2,789,280 less than during the first half of last year, but superior to those of 1863, or any former year. The chief items in the list of exports are silks, £6,580,000; woollens, £6,040,000; wine, £4,980,000.

Tobacco in France.—The revenue derived from tobacco in France forms, as in England, one of the most important items in the national accounts. The official returns for 1862, which have recently been published, show a net profit on that article approaching seven millions sterling. The amount sold was 28,300 tons, of which one-third was in the form of snuff, the quantity consumed per head on the average for the whole population being rather over a pound and a half. In some districts it amounted to nearly five pounds per head, while in others it did not exceed ten ounces. The whole of the manufacture is conducted by the Government, which has nineteen establishments; eight directions for the reception and storing of the foreign raw material—at Lille, Strasburg, Havre, Morlaix, Bordeaux, Tonning, Nice, and Marseilles; seven manufactories—at Paris, Bercy, Dieppe, Nantes, Châteauroux, Lyons, and Toulouse; and three establishments for the superintendence and storing of home-grown tobacco—at Metz, Vesoul, Cahors, and Algiers. The gross amount which passed thorough the Government manufactories during the year above named was nearly a hundred thousand tons. The capital employed in buildings, machinery, plant, and utensils of the Government establishments is given at £1,160,000, the average working expenses at £468,148 per annum. The dust produced in the factories is sold for purposes of fumigation, the powder being mixed with water in which sheets of coarse absorbent paper are steeped, and afterwards rolled and partially dried; when required for use they are laid upon the plate of a stove, in hot-houses or other places infected with insects. The tobacco water is used by cultivators as a means of stimulating the soil. A great deal of science and care is employed in the manufacture of tobacco in France, and the young men employed in the superior processes are drawn exclusively from the Polytechnic school.

Superior School of Commerce, Paris.—The annual examination of this new and excellent establishment, which has already been mentioned in the *Journal*, has just taken place, and the medals distributed by M. Boureuille, Secretary-General to the Minister of Commerce, who was prevented being present. The president was supported by the members of the council appointed to watch over the progress and study the means of improving the arrangements of the school, amongst whom were Messieurs Michel Chevalier, Emile Pèreire, Wolowski, Pelligot, Persoz, Arles Dufour, and other well known names. In his address, M. Boureuille said that the administration had, under instructions from the Emperor, commenced a rigorous inquiry into the condition of professional instruction in France, that in that inquiry commerce had not been forgotten, and that the report of the commission on the new school was highly favourable. The school is not yet large, the number of diplomas granted this year being only eight, and of the medals also eight, but its importance is not to be measured, at present at any rate, by the number of its scholars. Amongst the awards were a gold and a silver medal of honour given to the school by Prince Napoleon; the rest are furnished by the government. All the medallists were from the departments. Only two diplomas were granted to natives of Paris, one to a Bulgarian, another to a Greek, and a third to a Belgian.

Colonies.

Exhibition in Victoria.—The holding of a series of exhibitions of industry and art appears to be contemplated in this colony. It is proposed that the inaugural exhibition shall take place in Melbourne early next year, and a resolution in favour of granting a sum in aid of the project has been passed by the Legislative Assembly.

Tobacco in South Australia.—Some very fine specimens of tobacco, grown on a farm at Dandenong, have been forwarded to Melbourne for inspection. The application of guano has caused the leaves to attain quite an extraordinary size. The length of the longest leaf grown on the Experimental Farm is stated at 2ft. 2in. The specimens contain leaves measuring 2ft. 9in.

Post-office Savings Banks in Australia.—Among the measures before the colonial parliament is a bill to amend the post-office law. The object of it is to create post-office savings banks. Already there are 55 offices, in connection with which savings banks may be forthwith established. Deposits of 6d. and upwards will be received and interest allowed at 4 per cent.

Condition of South Australia.—Messrs. S. W. Silver and Co.'s special correspondent in South Australia, writes as follows:—"Adelaide, April 27th, 1865.—With one or two exceptions, all classes in South Australia are in a condition of high prosperity. The farmers have been blessed with two consecutive years of good crops, coupled with high prices. The great mines of Yorke and Peninsula—the Wallaroo and Moonta—have continued to yield in undiminished quantity, and several other mines of smaller importance are adding their contribution to our exports. Trade in Adelaide is sound and active, and to carry on their various industries labour is in brisk demand.

All efficient emigrants are very rapidly drawn into employment, and it has been resolved by Parliament to double the number of emigrants introduced at the public expense. The revenue at present accruing to Government is greatly in excess of expenditure, and it is estimated will, during the present year, amount to £800,000, a sum equal to the national debt of the colony. This large revenue is partly due to the fact that farmers are in the land market, to invest the unusual profits of the past two years. Crown land rates during the present year have already amounted to £118,596, whereas the annual average for a similar period since 1859 has been only £42,858. The increase in the proceeds of Crown lands is also to be ascribed to a policy, the soundness of which is much questioned, that of putting up land for sale in such a manner that the pastoral tenants of the Crown are compelled to buy large tracts of country to save their runs from being cut to pieces. These purchasers are not anxious to buy, as they have to incur heavy liabilities in order to do so—the Treasury does not want their money—and large slices of the public estate are thus getting alienated into a few hands. This policy would be the less to be regretted, however, if Parliament should avail itself of this opportunity to do what many people are agitating and hoping for, to do away with the Custom-house, and make Adelaide an entirely free port, in which event an immense and rapid stride in our prosperity might be reasonably expected. At present the squatters (the pastoral tenants of the Crown) are in an exceptionably depressed condition, although they still are, perhaps, on the average, the wealthiest class in the community. Their leases over a large part of the colony are falling in, and the re-valuation at which their runs are being re-let to them, amounting in many instances to ten times what they have been accustomed to pay, is astonishing them greatly, although it is not probably generally beyond what is fair to the public to demand. Over a large part of the colony they have been suffering from a very protracted drought, which has caused the death of sheep and cattle by thousands. As an incidental consequence it may be mentioned that the price of meat has risen greatly, but beef is retailed at 8d. per lb., being likely, according to good judges, to rise to 1s. The want of rain has also diminished the yield of our vineyards this year, and our wine growers are hardly in a position to stand a heavy check, as home consumption is so well supplied now that the price of wine has fallen. The squatters and the wine-growers are the two principal exceptions noted above to the special present prosperity of the producing classes in South Australia. The history of the colony for the past month has not been especially eventful. After a general election the fourth Parliament of South Australia has met, but, after a fortnight's session has adjourned till the 9th of May, having done little beyond voting supplies to the 30th of June, and agreeing to increased emigration, as already noted. A commission on national defences has sat and taken evidence, and has recommended the importation of improved artillery and rifles, and the re-organisation of the volunteer force. Our government is in communication with Downing-street on the subject of fresh postal arrangements with the mother country, and is prepared to add £5,000 to its annual subsidy to induce the ocean steamers to call at Kangaroo Island, or what would be preferred, some port on the South Australian mainland."

Wine in South Australia.—A large quantity of excellent wine is expected here this year. The produce, however, of 7,000 acres of grapes is far beyond the consumption of the colony. Vine growers are divided in opinion as to free distillation, but it is the general opinion that without that concession the large capital invested in South Australian vineyards cannot be remunerative.

The Sydney Mint Bill—making permanent provision for the establishment of the Sydney Mint—has passed through the Colonial Parliament. The object of the measure is to enable the gold coin of the colony to be made a legal tender in the United Kingdom, which concession has been promised by the Home Government upon permanent provision being made by the Sydney Mint. In the course of the debate on the second reading of the bill in the Assembly, doubts were expressed as to the advantage of the colonial sovereign having a currency in England, as, being of greater intrinsic value than the English sovereign, they were, on reaching London, melted and transmitted to the Bank of England in bullion.

South Australian Revenue.—The public income of South Australia for the year ended March 31st last, was £830,161, the balance in hand bringing the total up to considerably more than £900,000. This is without borrowing the money authorised by the Loan Bill of 1864. The increase upon the year's revenue was £170,616, a very large sum, especially considering that the previous year itself showed an increase upon its predecessor amounting to £133,514. The increase of revenue for the year 1865, March 31st, over and above the year ending 31st March, 1864, was therefore £304,130.

Census in Auckland.—From the last census, taken on 2nd December, 1864, it appears that, exclusive of the military, both imperial and colonial, and their families, the total population of the province on the above date was 37,008 souls, of whom 15,357 were females. The number of acres fenced was 128,705. There were under cultivation 87,147 acres, of which there were in wheat, 856; oats, 3,394; barley, 154; maize, 754; potatoes, 3,459; in garden or orchard, 1,855; unsown grasses, 75,680; and in other crops, 995 acres. Of live stock the province contained 7,233 horses, 111 mules and asses, 42,120 cattle, 73,145 sheep, 3,273 goats, 12,936 pigs, and 104,564 poultry. The number of military settlers and their families in the province of Auckland were—males, 4,035; females, 1089; total, 5,124; making the total population of the province when the census was taken, males, 25,686; females, 16,446; total, 43,132 souls.

The Murray Duties.—This question has excited considerable discussion of late in South Auckland, the government of New South Wales having, it is said, most abruptly terminated the engagement with that colony, and entered into negotiations with the government of Victoria respecting the collection of duties on goods passing up the Murray into the other colonies. The inhabitants of South Australia have also spoken strongly on the discourtesy thus shown to South Australia; and the Adelaide Chamber of Commerce have also, through the government, remonstrated with the government of the adjoining eastern colonies.

Notes.

Monmouthshire Prize Scheme Association.—The annual distribution of prizes provided by the iron and coal masters of this county took place recently. The bishop of the diocese presided, whilst the prizes were distributed by Sir Thomas Phillips, Q.C., assisted by the Mayor of Newport. The report of the Examiners showed that education is in a flourishing condition in this county; its prize scheme for the encouragement of elementary schools is extremely well supported. There were 325 candidates competing; out of this number 104 failed entirely. Sixty-four £10 prizes were distributed in money, whilst 134 books were awarded to the most proficient scholars in religious knowledge, and 220 certificates were also distributed. All schools in the county, irrespective of their creed, were admitted to the competition.

French Rural Education.—Frotey-lez-Vesoul, a small place near Vesoul, in the Haute Saone, has the honour of being the first rural commune in France to establish competitions in education and agriculture and the public distribution of prizes in its schools. The society which has taken this work in hand is called the Academy of Frotey, and aims at the establishment of a model commune, and further at aiding, by all the means

in its power, the efforts of the minister of public instruction towards creating prizes to be distributed annually in all the village schools in the empire, and in establishing annual competitions between the primary schools of each canton. One of these annual competitions is announced to take place on the twentieth of August, between the schools of Frotey and the seven adjoining cantons, and a *fête* took place at the Pré Catelan, in the Bois de Boulogne, on the 30th July, in aid of the funds of this benevolent society. The Emperor, in order to encourage the efforts of the Academy of Frotey, has placed a gold medal at its disposition, accompanied by a note, expressing his Majesty's approval and good wishes respecting the objects of the society.

Insect Destroyers.—The subject of the protection of small birds in the interest of the farmer has of late attracted as much attention in France as in England, and the following is the estimate of a French writer upon the subject:—" In former times, before such incessant and unmerciful war was waged against thrushes, blackbirds, nightingales, larks, tomtits, robins, finches, linnets, wrens, &c., it was calculated that there were ten thousand nests on the average to every square league of ground, and that there were on the whole about four eggs to each nest; further, that the parent bird ate about sixty caterpillars and gave a quarter of that number to each of its young per day, making a total of a hundred and twenty insects destroyed, or about thirty-six millions per month. Can anyone imagine the amount of mischief which would have been done by these millions of caterpillars to the leaves, flowers, and fruits of our trees; to all our kitchen-garden produce, and our ornamental shrubs and flowers?" The statistics of the case may be open to cavil, but there can be no doubt about the soundness of the inference in favour of these feathered friends of the farmer, the gardener, the florist, and the world at large.

Technical Female Education.—An excellent society has been in operation for some time in Paris, which has for its object the giving sound elementary and professional instruction to girls, and at the same time the preserving them from the dangers and inconveniences of the workshop. The founders of this philanthropic establishment are ladies, the wives of M. Jules Simon and other gentlemen, whose efforts on behalf of the working classes are well known. The society has already two establmishents in Paris, one in the Rue du Val Sainte Catherine, and the other in the Rue Rochechouart, and contemplates opening others in the metropolis as well as in the great manufacturing towns in the departments, as soon as its funds will permit. Each establishment unites the school and the workshop under the same roof. Pupils are admitted from the age of twelve years, without any distinction as regards creed, but a course of moral instruction forms part of the system. The morning is given to study, and the afternoon to work. The latter section is divided into five groups:—commerce, fabrication of garments, linen work, industrial design, and wood engraving. Each pupil has to pay ten francs a month, and prizes in money are distributed after the examinations. When the pupils have passed through the schools they are still protected by the society, which occupies itself with providing work for them, either in families or in respectable places of business. There are at the present time two hundred young girls in the establishments. The whole is supported by voluntary subscription; each founder pays a single sum equal to ten pounds; a titular member £1 a year; and subscribers what sums they think fit. This society has been formed without ostentation and without publicity, and is, beyond question, one of the most useful institutions which have sprung up in Paris by voluntary subscription.

Cost of Cleaning the Streets of Paris. — The sweeping of the macadamized roads costs £33,680 a year; the cleaning of the paved ways £91,000, of which £3,120 goes for materials, £20,400 for carting away the dirt, and the rest in paying the sweepers, who consist of women as well as men. The expenses of management and superintendence are £10,400. Total expenditure, £135,080.

The Sardine Fishery.—This industry is one of considerable importance on certain parts of the French and Italian coast. A letter addressed to the *Phare de la Loire*, from Douarnenez in the department of Finistère, in the last week of July, announced the appearance of these little fish, and states that the average take had since been from five to six thousand sardines per boat.

Patents.

From Commissioners of Patents Journal, August 4th.

Grants of Provisional Protection.

Boots and shoes, cuttings the soles of—1868—J. P. Wint.
Carriages, springs for railroad and other—1860—J. C. Walker.
Cruet frames—1848—J. B. Chatterley.
Dovetails for joiners, machinery for cutting—1671—W. Roberts.
Fire-arms, breech loading, and cartridges for—1750—W. E. Newton.
Flax for scutching, treating and preparing—1828—G. Firmin.
Foods for animals, preparation and preservation of—1857—R. V. Tuson.
Lifts for raising passengers, &c., to upper floors of hotels—1822—D. Cowan.
Light for photographic and other purposes—653—P. Carlevaris.
Lime, superphosphate of, from guano—1790—A. V. Newton.
Machines or engines, steam pumping—1700—M. Benson.
Mandrils for rollers used in printing or embossing—1850—D. and J. Fulton.
Mattresses, &c., material for stuffing—1800—T. F. Henley.
Puddling, balling, heating, and melting metals, furnaces for—1882—D. Caddick.
Pumps—1864—R. A. Brooman.
Rails for railways and tramways, connecting—1878—C. Henderson.
Railway signals—1856—A. de Metz and T. W. Fry.
Railways, permanent ways of, and locomotives applicable thereto—1593—W. J. Hixon.
Rocks, &c., machinery for boring—1778—G. Low.
Silk, &c., winding—1872—J. B. Whitehall and T. Pillings.
Skelps for iron or steel tubes—1858—S. Hingley.
Sluices or dams, construction of—1870—T. W. Wood.
Sowing seeds and depositing manure, drills for—1867—J. Armitage.
Steam, apparatus for increasing the mechanical power of—1820—W. A. Lyttle.
Trains by atmospheric pressure, locomotion of—1852—W. P. Bayliss.
Vermin traps—1886—J. Miles.
Weaving, looms for—1876—M. Knowles.

Invention with Complete Specification Filed.

Hats—1971—T. D. Stetsen.

Patents Sealed.

325. R. A. Brooman.
338. C. Lungley.
339. A. T. L. Gordon.
342. R. de Bray.
343. J. B. Watters.
345. J. Lake.
349. G. Twigg.
358. E. Lindner.
360. R. A. Brooman.
367. M. Peck.
368. J. P. Lindsay.
374. E. Leigh.
382. H. Emanuel.
385. G. C. and J. B. Haseler.
386. J. and J. Porter.
387. C. Atherton & A. H. Renton.
391. W. Crookes.
427. S. R. Freeman & A. Grundy.
457. W. Clark.
1218. W. E. Newton.
1219. W. E. Newton.

From Commissioners of Patents Journal, August 8th.

Patents Sealed.

379. H. W. Hart.
384. D. H. Barber.
388. J. Hall.
395. J. Cass.
399. D. Barr, W. H. Page, and J. C. Newey.
402. L. H. G. Ehrhardt.
403. J. A. Pastorelly.
405. J. G. Tongue.
415. W. F. Batho.
416. R. J. Jones.
417. G. Whitton.
419. E. H. Newby.
420. J. Trotman.
436. G. T. Humphris.
449. F. A. Laurent, J. Cathelaz, and N. Bassett.
450. J. Thompson.
451. R. Smith.
508. W. S. Mappin.
590. W. E. Newton.
615. W. E. Newton.
699. J. Atkins.
703. J. Webb.
727. W. E. Newton.
937. P. J. Jamet.
1594. A. Robinson.

Patents on which the Stamp Duty of £50 has been Paid.

2187. T. G. Webb.
2193. G. Coles, J. A. Jaques, and J. A. Fanshawe.
2198. J. Townsend.
2206. W. G. Valentin & F. Levick.
2199. J. Gray.
2209. M. A. F. Mennons.
2203. W. W. Burdon.
2227. J. Tatham.

Patents on which the Stamp Duty of £100 has been paid.

1769. J. J. Russell.
1799. J. Smith.
1794. S. Carey.
1804. J. Walker.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, AUGUST 18, 1865. [No. 665. VOL. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

PROGRAMME OF EXAMINATIONS FOR 1865.

PRELIMINARY NOTICE.

I. The Examinations described herein have been established for the benefit of the members and students of Institutions in Union with the Society of Arts. Such persons are commonly mechanics, artisans, soldiers,* labourers, clerks, tradesmen and farmers in a small way of business, apprentices, sons and daughters of tradesmen and farmers, assistants in shops, and others, of various occupations, who are not graduates, undergraduates, nor students of a University, nor following nor intending to follow a learned profession, nor enjoying nor having enjoyed a liberal education. To all such members and students, and persons of the like condition, male and female, not being nor having been professional teachers or pupil teachers, the Examinations, certificates, and prizes, described in this programme, are open on the general conditions stated herein. Persons who are, or have been, professional teachers, or pupil teachers, may obtain certificates, but cannot compete for prizes.†

II. The certificates are not competed for. They are awarded as records of positive not comparative attainment. The prizes are competed for.

III. For the conditions on which persons of a higher grade in society may be examined and receive certificates, but not compete for prizes, see par. 10 (D).

IV. The candidates for Examination have not to go to a distance from their homes. The examinations are held in all places in the United Kingdom where a Local Educational Board connected with the Society of Arts is willing to make the requisite arrangements.

V. For a list of the Local Boards already formed, see page 624.

VI. For instructions as to the formation of Local Boards and their duties, see page 617.

The EXAMINATIONS are twofold—

(1.) The Previous Examinations by District Unions and Local Boards for persons of any age not under 12.

(2.) The Final Examination by the Society of Arts Board of Examiners, under the supervision of the Local Boards, for persons of any age not under 16.

PREVIOUS EXAMINATIONS BY DISTRICT UNIONS AND LOCAL BOARDS.

1. These are intended to serve two purposes:—

(1st.) To "sift" the Candidates for the Final Examination, so as to keep back those who, not being yet fairly grounded in the elements of education—spelling, writing, and arithmetic—nor fairly acquainted with the subject or subjects in which they desire to be examined by the Society of Arts, are unlikely to succeed in that Examination. The sifting in elementary subjects may be effected in any mode at the discretion of the Local Boards; but they are recommended (for the sake of convenience and uniformity) to adopt the "Scheme of Elementary Examinations" given below. The best mode of sifting the Candidates in the subjects in which they desire to be examined by the Society of Arts is for the Local Boards to examine them therein by means of printed (or written) questions and written answers; but, where a Local Board finds itself without the means of conveniently holding such an Examination in any special subject, such Board may satisfy itself in any other mode, and state simply that it has satisfied itself, that the Candidate is fit to be examined by the Central Board in that subject.

2. (2nd.) To encourage and lead on those who, from the insufficiency of their age or of their elementary knowledge, are not yet qualified for admission to the Final

* The following circular memorandum (Gen. No. 331), addressed to the army at home, has been issued:—"Miscellaneous 1 (1865).—The Field Marshal Commanding-in-Chief desires it to be notified that there will be no objection to soldiers, their wives, and families, being permitted to present themselves for instruction and examination at the Educational Institutes in connection with the Society of Arts, on the understanding that they are not on that account to be exempted from any military duty, nor, except in special cases, to be out of barracks after watch-setting or tattoo.—By command of his Royal Highness the Field Marshal Commanding-in-Chief, JAMES YORKE SCARLETT, Adj. Gen.—Horse Guards, S.W., 11th March, 1865."

† Except in some special cases where prizes are expressly offered by local bodies to pupil teachers.

Examination of the Society of Arts, but desire to obtain minor certificates from the District Unions and Local Boards.

3. The beneficial effect of such Examinations in elementary knowledge is greatly enhanced where prizes are offered by the District Unions and Local Boards to be competed for by the Candidates.

Scheme of Elementary Examinations for 1866.

4. This scheme has been agreed on by the representatives of the District Unions in connexion with the Society of Arts, and presents therefore the advantages of a common standard of uniform Examination Papers, and of common forms of Certificate to be granted by the various District Unions and Local Boards.

5. It is in two grades, and the Candidates should be allowed to select either grade at their discretion.

Lower Grade.

1. Every candidate must be examined in the first four rules of Arithmetic, simple and compound.

2. Female candidates must also be examined in plain needle-work.

3. Male candidates must also be examined in *one* at least of the three following subjects:—

A. A General knowledge of the Gospel History.

B. The rudiments of English History.

C. The rudiments of the Geography of England.

4. Fairly good writing and spelling, with good reading of a simple narrative, will also be required.

5. A satisfactory examination will entitle the candidate to a certificate from the District Union or Local Board.

Higher Grade.

1. Every candidate must be examined in Arithmetic, including the Rule of Three, Decimal and Vulgar Fractions.

2. Every female candidate must also show proficiency in needle-work.

3. Male candidates must also be examined in *one* at least of the three following subjects:—

A. The facts of St. Matthew's Gospel and the Acts of the Apostles.

B. A General knowledge of English History, and especially of the reign of George III.

C. The Geography of Great Britain and Ireland.

4. A fairly good handwriting, spelling, and knowledge of grammar will also be required.

5. A satisfactory examination will entitle the candidate to a certificate from the District Union or Local Board.

6. These Examinations must, in 1866, be held on the 13th and 14th March, after three o'clock, p.m.

7. The Secretary of each District Union and Local Board desiring to use the Elementary Examination papers,* and the Forms of Certificate, provided for common use, must apply for them to the Secretary of the Society of Arts, before the 13th of February, stating the number of *male* and *female* candidates respectively in *each grade*. The Examination papers will be forwarded to the Secretary of the Board, but must of course be kept secret from the candidates until the time of the Examination.*

* The uniform Examination Papers afford a common standard of examination; and, to promote uniformity in the application of that standard, special copies of the examination papers, with the number of marks to be awarded for a complete answer to each question, will be printed for the use of the examiners alone. Thus, suppose that in a paper there are twelve questions, and that the aggregate number of marks assigned to the paper is 120; the number of marks placed opposite to each of the questions will depend upon their relative difficulty, and the proportion of these marks given by the examiner for the answer of any candidate will depend upon its accuracy and completeness. Supposing a perfect answer to a question to be set down as worth 20 marks, an examiner may award 20, 15, 12, or any less number, according to the merit of the answer. Thus the candidates all over the country, though their papers be tested by different examiners, will be placed as nearly as possible upon an equal footing. No candidate should receive a certificate who does not obtain at least 30 marks in *each* paper, the whole paper being worth 120 marks. In the subjects of reading, writing, spelling, and needlework, it is not thought desirable to fix any number of marks as a standard of proficiency. It is important that the same person should examine *all* the candidates in any one subject at any centre.

8. When the Previous Examinations are completed, a return, in the following form, must be made to the Secretary of the Society of Arts, who will then forward the proper number of blank Forms of Certificate to be awarded by the Local Board:—

Elementary Examinations, 1866.

Name of Board or District Union. } ——————

No. of Centres ———

	Higher Grade.		Lower Grade.	
	Examined.	Passed.	Examined.	Passed.
Males................				
Females				
Totals				

FINAL EXAMINATION BY THE SOCIETY OF ARTS.

9. No Candidate can be admitted to the Final Examination without a Certificate or Pass from a District Union or Local Board, before which he or she has passed a Previous Examination.

10. Every admitted Candidate must be at least 16 years of age.

(*A*.) Members of, or students of classes in, Institutions in Union with the Society of Arts, are examined ... ... Free.

(*B*.) Members of, or students of classes in, Small Institutions,† not in Union with the Society of Arts, but subscribing one guinea a year for admission to the Examinations alone, are examined ... ... Free.

(*C*.) Members of, or students of classes in, "Small Institutions"* not in Union with the Society of Arts, but connected with it through a District Union or Local Board, are examined on payment of a fee of ... ... 2s. 6d.

(*D*.) Persons of a higher class of society than those described in paragraph 1. (Preliminary Notice), are examined on payment of a fee of 10s. 6d.

N.B. The Council in every case leave it to the Local Board to decide whether a candidate should pay this higher fee.

11. Candidates coming under the head (*D*.), as well as Professional Teachers and Pupil Teachers, though they may receive certificates, cannot compete for prizes.

12. A copy of Form No. 2 will be forwarded, on the 1st March, to the Secretary of each Local Board, and must be filled up and returned to the Secretary of the Society of Arts before the 20th March. The requisite number of forms No. 4 will then be forwarded, and these, when filled up, must be returned not later than the 2nd of April. Each of these forms, when returned, will be numbered at the office of the

* In any case in which a Local Examining Body may examine candidates in the doctrines of Holy Scripture, in the Prayer Book, or in any other religious formulary, the results of such Examination may be stated, by that local Examining Body, on the certificate; though the form of certificate provided for common use does not include religious doctrine. The "Metropolitan Association for Promoting the Education of Adults" announces that at its request the Bishops of London and Winchester have established collateral examinations in the Bible and Prayer Book, with certificates and prizes for those certificates of that Association who may desire to undergo examinations in such subjects.

† Small Institutions are defined as those which have an income of less than £75 a year.

Society of Arts, and a card for each candidate, with his name and his number, will afterwards be forwarded to the Secretary of the Local Board for distribution, together with copies of the time-table.

13. The printed papers of questions in the various subjects will be afterwards forwarded to the Secretary of the Local Board; the whole of the papers appointed for each of the evenings of the Examination being contained in a separate sealed envelope, which is not to be opened till the Candidates are present, at half-past six on that evening.

14. Precise details as to the mode in which the Final Examination is to be conducted are contained in the Letter of Instructions, and members of the Local Boards should make themselves thoroughly acquainted with them.

15. When the Candidates' papers have been submitted to the judgment of the Society's Examiners, certificates of three grades will be awarded, and the names of the Candidates who obtain prizes and certificates will be afterwards published in the *Journal of the Society of Arts*.

16. A Candidate who has obtained from the Society a certificate of the 1st class in any subject cannot again be examined in the same subject; but a Candidate who has obtained a certificate of the 2nd or 3rd class may, on the recommendation of the Local Board, be examined in the same subject, in a subsequent year, without again passing the Previous Examination.

17. A Candidate who, having obtained a certificate in any subject, desires to be examined in some other subject, in a subsequent year, may be "passed" by the Local Board, after examination in that subject, without re-examination in the elementary subjects; but, in all cases, the name must be returned in the proper form (No. 4).

18. Particulars of the subjects for the Final Examination are given.

19. The Time-table has been drawn up to meet the general convenience of the Candidates; and *no variation* of it can *possibly* be allowed, so that, in choosing the subjects in which they desire to be examined, Candidates must take notice of the arrangements of this Time-table, as they *cannot* be examined in *two* subjects which are set down for the same evening. The hours of Examination must be strictly adhered to.

20. The Examiners will reject all ill-written, ill-spelt, ill-composed, or ungrammatical papers that may be laid before them.

Time-Table for 1866.

Tuesday, 24th April, From 6.30 to 9.30 p.m.	Wednesday, 25th April, From 6.30 to 9.30 p.m.	Thursday, 26th April, From 6.30 to 9.30 p.m.	Friday, 27th April, From 6.30 to 9.30 p.m.
Arithmetic.	Book-keeping.	Algebra.	Geometry.
Trigonometry.	Navigation, &c.	Practical Mechanics.	Mensuration.
Electricity and Magnetism.	Conic Sections.	Animal Physiology.	Principles of Mechanics.
Light and Heat.	Chemistry.	Political and Social Economy.	Botany.
Mining and Metallurgy.	Music.	French.	Geography.
Geometrical Drawing.	Domestic Economy.	†English Literature.	Latin.
German.	English History.	Fruit and Vegetable Culture.	Logic and Mental Science.
Floriculture.	Italian.	Freehand Drawing.	Spanish.

† Two Papers of one hour and a half each in this subject are considered as one.

LOCAL EDUCATIONAL BOARDS.

21. Local Boards may be formed wherever the managers of Institutions, or other persons, may be prepared to co-operate with the Society of Arts.

22. Each Local Board must consist of at least three members, and must have a Chairman and a Secretary. The district for which the Board is to act should be defined; and every Educational Institution within those limits should be represented in the Board. The composition of the Board must be such as to command the respect and confidence of the neighbourhood. No member or officer of a Local Board can be admitted to the examinations.

23. The duties of the Local Boards may be defined as follows:—

(*A*) To give publicity to the system of Examinations by the circulation of the programmes, hand-bills, &c. (copies of which will be furnished *gratis* on application), and to give encouragement and advice to those young persons who are likely to become candidates.

(*B*) To hold the Elementary or Previous Examinations.

(*C*) To superintend the Final Examinations.

24. Local Boards make no payment to the Society, unless they exercise the power of admitting candidates who are not members of any Institution in union with the Society of Arts (see par. 10 *C*.); in which case a subscription of one guinea a year must be paid.

25. A detailed list of each Local Board (giving the exact address of the Secretary) must be submitted to the Council of the Society of Arts before the 1st of February, 1866, when the general list of such Boards will be published; and where a Local Board comprises so large a district that, for the convenience of the candidates, Branch Local Boards have to be formed, lists of these must also be given. All changes in the composition of the Boards must be notified to the Society of Arts.

SUBJECTS FOR THE FINAL EXAMINATION IN 1866.

***** Owing to the small number of candidates desiring (for several years past) to be examined in Astronomy and Agriculture, the Council, on the recommendation of the Education Committee, have removed these two subjects from the list; but should they be informed, in any subsequent year, that these subjects are being studied by any considerable number of candidates, they will feel pleasure in restoring them to the Programme. No paper will be set in Conic Sections unless information is received before the 1st of January, 1866, that several candidates are intending to be examined in that subject.**

26. In the following paragraphs will be found brief outlines of the subjects in which candidates may be examined, and their attention is especially drawn to this part of the Programme. In many instances the Examiner has set down certain Text-books; but, in most cases, a candidate may exercise his own judgment as to what Text-Book he uses; real knowledge, however or wherever acquired, will be accepted by the Examiners. In the following subjects, however, Political Economy, English History, English Literature, Logic, Latin and Roman History, French, German, Italian, and Spanish, the course of study is necessarily prescribed with more or less exactness.

I.—Arithmetic.

Examiner.—Rev. Alexander Wilson, M.A., National Society, London.

27. Practice—Simple and Compound Proportion—Interest—Discount—Insurance—Vulgar and Decimal Fractions; with the principles of a Decimal Notation in money on the basis of the pound unit.

28. The questions framed from the preceding syllabus will consist mainly of practical problems, and the Examiner will take into account not only the correctness of the answers, but also the excellence of the methods by which they are worked out, and the clearness and neatness of working, *which must always be shown.*

29. Text Books:—Any of the modern treatises on Arithmetic, such as Hunter's Text Book (*National Society*), Colenso (*Longmans*), or Barnard Smith (*Macmillan*).

II.—Book-keeping by Double Entry.

Examiners.—John Ball, Esq., of the firm of Messrs. Quilter and Ball, and Robert G. C. Hamilton, Esq., Principal Accountant to the Committee of Council on Education.

30. Candidates should be prepared to answer questions as to the nature and use of the different books usually kept in a merchant's office; to journalize a series of transactions from a waste book, and having posted the entries to the ledger, to balance the accounts, to prove the correctness of the postings by a trial balance, and finally to exhibit an account of profit and loss, and a balance sheet.

31. Text Books:—Rudimentary Book-keeping (*Weale's Series*). Kelly's Elements of Book-keeping (*Simpkins and Co*). Examination-Questions in Book-keeping by Double Entry, by the Rev. J. Hunter, M.A. (*Longmans*).

III.—Algebra.

Examiner.—J. J. Sylvester, Esq., M.A., F.R.S., Professor of Mathematics at the Royal Military Academy, Woolwich.

32. Elementary Operations and Fractions, Simple and Quadratic Equations and Problems leading to them. Involution and Evolution. Surds. Arithmetical, Geometrical, and Harmonic Series. Combinations and Permutations. Binomial Theorem. Scales of Notation. Interest and Annuities. Elementary Theory of Probabilities.

33. Text Books:—Todhunter's Algebra (*Macmillan*), Colenso's Algebra (*Longmans*), Lund's, or any other modern treatise on Algebra.

IV.—Geometry.

Examiner.—Rev. B. Morgan Cowie, M.A., Professor of Geometry at Gresham College; one of H.M. Inspectors of Schools.

34. To obtain a first-class certificate, at least six problems and four propositions must be correctly done; to obtain a second-class, at least four problems and eight propositions.

35. Text Books:—Euclid, Books I., II., III., IV., VI., XI., as far as Prop. 21. Potts' smaller edition (*Parker*). Green's Euclid's Plane Geometry, practically applied, is a useful help to those who are studying by themselves (*Heywood*, Manchester; *Simpkin, Marshall and Co.*, London).

V.—Mensuration.

Examiner.—John Sykes, Esq., M.A., Assistant-Secretary to the Committee of Council on Education.

36. The calculation of the areas and circumferences of plane figures bounded by arcs of circles or right lines, and solid contents of cones, cylinders, spheres, &c. Candidates will be expected to be familiar with the different rules for measuring and estimating artificers' work, such as joiners', bricklayers', masons', and plumbers' work, and to be able to prepare estimates of such work from given quantities.

37. Text Books:—Lund's Mensuration, Part III., of his Elements of Geometry and Mensuration. Tate's Mensuration. Young's Treatise on Mensuration (*Simms and M'Intyre*).

38. The Examiner, in referring to last year's papers, complains of the "want of due attention to the elements of the subject," and says of the candidates that "in the geometrical part their work is satisfactory, but in the arithmetical part it is not."

VI.—Trigonometry.

Examiner.—Rev. T. G. Hall, Professor of Mathematics in King's College, London.

39. In Plane Trigonometry, the formulas for the trigonometrical functions of angles, the numerical solution of plane triangles, the use of logarithmic tables, and angular and exponential series.

40. Spherical Trigonometry, Napier's Rules, and the Solution of Spherical Triangles.

41. Text Books:—Snowball's or Todhunter's Trigonometry, Hall's Trigonometry for Schools for Spherical Trigonometry (*Christian Knowledge Society*), or any other of the modern treatises on Trigonometry. Mathematical Tables (*Chambers' Series*).

VII.—Conic Sections.

Examiner.—Rev. Bartholomew Price, M.A., F.R.S., Sedleian Professor of Natural Philosophy in the University of Oxford.

42. The properties of the three curves treated geometrically; also as deduced from the cone. The principles of projection, orthogonal and central, applied to derive the properties of the conic sections from those of the circle.

43. Analytical Conics, including the equations of the straight line, the circle, the three conic sections, and the general equation of the second degree.

44. Text Books: Drew's Conic Sections (*Macmillan.*) Taylor's Conic Sections (*Macmillan*). Salmon's Conic Sections (*Longmans*). Todhunter's Conic Sections (*Macmillan*).

45. *** Notwithstanding the small number of candidates that have appeared in this subject for several years past, the Council are unwilling to remove it from the list, on account of its practical value, especially to workmen employed in cutting wood and stone, and in the arts of construction generally, but no paper will be prepared in it this year, unless information should be received, before the 1st January, 1866, that several candidates are desirous of being examined in it.

VIII.—Navigation and Nautical Astronomy.

Examiner.—Rev. Joseph Woolley, LL.D., one of Her Majesty's Inspectors of Schools.

46. A good knowledge of Plane and Spherical Trigonometry, of the definitions and terms used in Nautical Astronomy, and of the various measurements of time and their mutual conversions will be required, as well as skill in the use of logarithmic tables, and neatness, order, and accuracy in the numerical solutions of problems.

47. The candidate should understand the construction of charts; the nature and laws of circular storms; great circle sailing, &c.; the methods of determining the latitude, longitude, variation of the compass, and error and rate of a chronometer by astronomical observations, with the demonstrations of the formulæ employed; the use of nautical astronomical instruments, &c.

48. Text Books:—The Nautical Almanac (*Murray.*) Riddle's Navigation and Nautical Astronomy (*Law*, Essex-street.)

49. N.B. Candidates in this subject should be allowed theuse of the Nautical Almanac and Tables *during the Examination.*

IX.—Principles of Mechanics.

Examiner.—Rev. Jonathan Bates, M.A., Fellow of Gonville and Caius College, Cambridge.

50. The properties of matter, solid, fluid, and gaseous.

51. Statics: The composition, resolution, and equilibrium of pressures acting on a material particle, and on constrained particles; machines; attractions.

52. Dynamics: the laws of motion; impact; projectiles; constrained motion; central forces; oscillation.

53. Rigid Dynamics: Motion of a rigid body about a point;—of a free rigid body;—of a system of rigid bodies.

54. Hydrostatics: Pressures of fluids; equilibrium of floating bodies; specific gravity; elastic fluids; machines; temperature and heat; steam; evaporation.

55. Hydrodynamics: Motion and resistance of fluids in tubes, &c.; waves and tides.

56. Pneumatics: Mechanical properties of air; the barometer, and other machines illustrating the mechanical properties of air.

57. Text Books:—Todhunter's Statics, or Parkinson's Mechanics. Goodwin's Mathematics. Miller's, Phear's, or Besant's Hydrostatics. Webster's Theory of Fluids.

The treatise on this subject in Orr's Circle of the Sciences. Golding Bird's Elements of Natural Philosophy, by C. Brooke (*Churchill*). Lardner's Handbooks on Natural Philosophy.

58. The Examiner, in referring to last year's candidates, regrets "a want of clearness and perspicuity, which spoils the effect of the results," and adds "a word of caution to the candidates as to more earnest effort to secure method, well-digested arrangement, and neatness in their papers."

X.—Practical Mechanics.

Examiner.—T. M. Goodeve, Esq., Professor of Mechanics at the Royal Military Academy, Woolwich.

59. The applications of the Principles of Mechanism to Simple Machines. The Steam Engine.

60. Text Books:—Bourne's Catechism of the Steam Engine (*Longmans*). Scott Russell on the Steam Engine. Nasmyth's Elements of Mechanism, with remarks on Tools and Machinery (*Weale*). Goodeve's Elements of Mechanism (*Longmans*).

XI.—Electricity and Magnetism.

Examiner.—Charles Brooke, Esq., M.A., F.R.S., Surgeon to the Westminster Hospital.

61. Construction and Properties of Magnets; Magnetic Instruments; Terrestrial Magnetism; Diamagnetism.

62. Statical or Franklinic Electricity; Voltaic Electricity; Electro-dynamics; Electro-telegraphy; Electro-metallurgy; Thermo-Electricity; Organic Electricity.

63. Text Books:—Golding Bird's Elements of Natural Philosophy, by C. Brooke (*Churchill*). Lardner's Handbooks of Natural Philosophy (*Walton and Maberly*). Fleeming Jenkin's report on the Electrical Instruments in Class XIII. of the Exhibition of 1862, for Electro-telegraphy. Herschel's Discourse on the Study of Natural Philosophy (*Longmans*) for a *general* view of the subjects.

64. The Examiner, in his last year's report, observes, that "the mariner's compass, its construction, its deviations, and the most practicable methods of correcting the errors therein arising, does not yet appear to command the attention of advanced students to the extent the subject is entitled to, considering the present vast and increasing importance of iron in marine architecture."

XII.—Light and Heat.

Examiner.—Richard Potter, Esq., A.M., late Professor of Natural Philosophy and Astronomy in University College, London.

65. What is the sense of sight?—ancient theories—modern definitions and hypotheses of the nature of light—the especial privileges of animals which possess organs of vision—the simple laws or properties of light required to be known before we can discuss the structure of the eye, and the construction of telescopes, microscopes, and other optical instruments—optical images real and virtual—how do they occur in optical instruments.

66. Why do we distinguish between Physical and Geometrical optics?—what are double refraction of light—polarization of light—interference of light—examples of these properties, how shown—phenomena of recurring colours—examples—how are explained the colours of the soap bubble—the colours seen on looking towards a light through the feathers of small birds—the colours of mother of pearl—the rainbow, &c., &c.—the laws of the interference of polarized light—to describe cases of these splendid phenomena.

67. What are the definitions of heat, radiant, latent, and sensible?—what is meant by caloric?—hypotheses of the nature of heat—capacity of bodies for heat—the temperature of bodies—how measured by instruments—descriptions of thermometers and pyrometers—the scales of thermometers—how compared—how the volumes of solids, liquids, and gases, depend on their temperature—absolute zero of cold—elastic force of vapours and gases produced by heat employed in steam and air engines—winds from the unequal heat of the atmosphere. What are the connexions and analogies of heat and light?

68. Text Books:—The Library of Useful Knowledge. Brewster's Optics (Cabinet Cyclopædia). Potter's Physical Optics, the descriptive and experimental treatise (or first part) (*Walton and Maberly*).

XIII.—Chemistry.

Examiner.—A. W. Williamson, Esq., F.R.S., Professor of Chemistry, University College, London.

69. Preparation and properties of the chief gases, acids, bases, and salts. Laws of combining proportion by weight and by volume. Analytical processes for the detection and separation of metals, acids, &c. Preparation and distinctive properties of the chief kinds of alcohol, of organic bases, fixed and volatile organic acids, sugars, woody-fibre, starch, &c.

70. Candidates are expected to be able to explain chemical reactions by the use of symbols. Questions illustrative of general principles will be selected from the following, amongst other manufactures: Metallurgy of Lead, Iron, and Copper; Bleaching, Dyeing, Soap-boiling, Tanning; the manufacture of Coal-Gas, Sulphuric Acid, Soda-Ash, &c.

71. Text Books:—Miller's Elements of Chemistry. Williamson's Elements of Chemistry (will appear in October, 1865).

XIV.—Mining and Metallurgy.

Examiner.—J. Arthur Phillips, Esq., Civil Engineer, Graduate of the Imperial School of Mines of France, &c.

72. Candidates should be able to identify with facility the ores of the more common metals, and be acquainted with their chemical composition. They should also be familiar with the forms of occurrence of the various metallic ores, and the usual methods employed for their extraction and subsequent purification by crushing, stamping, washing, &c. Underground surveying, the principles of ventilation, particularly as applicable to collieries; a knowledge of furnace assaying, and a general acquaintance with the metallurgy of the more important metals are also required.

73. First-class certificates can be given to those only who have either acquired some practical knowledge of mining, or who possess a special acquaintance with the metallurgy of at least one of the useful metals.

74. Text Books:—Dana's Mineralogy (*Trubner and Co.*, Paternoster-row). Mitchell's Assaying (*Baillière*). Manual of Metallurgy (*Griffin*). Useful metals and their Alloys (*Houlston and Wright*). Ure's Dictionary of Arts, Manufactures, and Mines (*Longmans*). Percy's Metallurgy (*Longmans*). Metallurgy of Iron, Truran (*Spon*).

XV.—Botany.

Examiner.—Daniel Oliver, Esq., F.R.S., F.L.S., Keeper of the Herbarium at the Royal Gardens, Kew, and Professor of Botany in University College, London.

75. Sect. I.—The Structure of Plants and Vegetable Physiology. The Functions of the Various Organs, and their Morphological Relations. The Nature of the Principal Tissues. The Meaning of Botanical Terms. The application of Structural and Physiological Facts to Practical Purposes.

76. Sect. II.—Systematic Botany. The general principles upon which the Classification of Plants is based. The distinctive characters of the principal British Natural Orders of Plants. Naming Common Wild Flowers at Sight. The sources of the most important Economic Vegetable Products:—Timbers, Fibres, Fruits, Drugs, &c.

77. Section III.—Descriptive Botany. The Art of Describing Plants Correctly in Scientific Language.*

78. Text Books:—Lindley's School Botany (*Bradbury and Evans*); Oliver's Lessons in Elementary Botany (*Mac-*

* Living plants are provided by the Society for this examination.

millan); Lindley's Theory and Practice of Horticulture (*Longmans*); Oliver's Guide to the Kew Museums (pamphlet) (*L. Reeve and Co.*).

79. Candidates will be expected to return three correct answers to questions in Section I., three in Section II., and at least two of the plants must be described and referred to their respective natural orders in Section III.

80. Students are very strongly recommended to the frequent practice of describing plants; at first on forms or "schedules," as given in Professor Oliver's "Lessons," page 59, and, when sufficiently advanced, in detail, as in the examples given at page 293 of the same work, and in Dr. Lindley's "School Botany."

81. The Examiner observes:—"All candidates would do well to handle living plants frequently, dissecting and describing them as they go on, in accordance with the examples given in the works recommended to them as text-books."

XVI.—Floriculture.

Examiner—**Thomas Moore, Esq., F.L.S., Botanic Gardens, Chelsea.**

82. The candidates will be expected to answer questions on any of the undermentioned subjects:—

83. The leading Flowers of the different seasons, indicating those to be obtained naturally, and those by artificial means. Leaf Buds and Flower Buds, the conditions favourable to their development respectively. Food of Plants, how and whence derived, and in what form received. Manuring, substances best adapted for Flower Culture.

84. Improvement of Races in Plants, how has it been effected, and by what means can it be carried forward? Hybridization, objects and guiding principles of. Conditions necessary to ensure fertility in Flowers.

85. Construction of Houses for Plant Culture. Warming and Ventilation. Influence of Ventilation on Plants confined in forcing houses. Limits of Temperature endurable by Plants, and how to turn this to advantage in Practical Floriculture. Bottom heat, value of in Plant Culture. Watering, the *rationale* of—what to avoid. Liquid Manures.

86. Propagation, the various modes of, and their special adaptations. Germination of seeds, conditions favourable and unfavourable to. Vitality of seeds, duration of, and how best preserved. Treatment of Seedling Plants. Budding, Grafting, and Inarching, how performed, and to what subjects best adapted. Increase by cuttings and by layers. Leaf-cuttings, how is it that they can organize buds? Potting. Composts.

87. Acclimatisation. Is it possible to increase the hardiness of any race of plants, and by what means?

88. Text Books:—Lindley's Theory and Practice of Horticulture (*Longmans*), McIntosh's Book of the Garden (*Blackwood and Sons*), Thompson's Gardener's Assistant (*Blackie and Son*).

XVII.—Fruit and Vegetable Culture.

Examiner—**Robert Hogg, Esq., LL.D.**

89. Sect. I.—*Fruit-Tree Culture.*—Kinds of Fruits adapted for various soils and exposures. The Propagation, Pruning, and Training of Fruit Trees. The Forcing of Fruit Trees, and their cultivation under glass, both in and out of pots. The Theory of Ripening, and the principles that ought to regulate the preservation of fruits after they are ripe or their subsequent maturation. The Packing of Fruit for transmission to great distances.

90. Sect. II.—*Vegetable Culture.*—The kinds and quantities of vegetable seeds and roots required for cropping gardens of given dimensions. The culture of the different kinds of vegetables and salads. The preparation of fermenting materials for artificial heating. The forcing of vegetables and salads.

91. Sect. III.—*General Subjects.*—Soils, Water, Atmospheric Air, Light and Heat in their relation to the successful cultivation of Fruit and Vegetables. Manures and their application. The Diseases and Insects to which Fruit Trees and Vegetables are subject and their remedies. The Structure and Functions of the Organs of Plants, considered in their relation to growth and reproduction. The erection, heating, and ventilation of garden structures.

92. Text Books:—Loudon's Suburban Horticulturist. Johnson's Cottage Gardener's Dictionary (*Bohn*), Hogg's Fruit Manual (171, *Fleet-street*).

XVIII.—Animal Physiology in Relation to Health.

Examiner.—**John Marshall, Esq., F.R.S., F.R.C.S., Surgeon to the University College Hospital, and Lecturer on Anatomy at the Government Department of Science and Art.**

93. The general principles of Animal Physiology, and the application of them to the preservation of health and to the wants and emergencies of daily life.

94. Text Books:—Carpenter's Animal Physiology, 1859 (*Bohn*). Mapother's Physiology and the Principles of Disease (*Longmans*). Mapother's Lectures on Public Health (*Longmans*). Lardner's Animal Physics (*Walton and Maberly*). Translation of Milne Edwards' Manual of Zoology (*Renshaw*). Marshall's Descriptions of the Human Body, with Atlas (*Day and Son*), for details of Anatomy.

95. The Examiner, in a very elaborate report on the last examination, describes a large proportion of the rejected candidates as "immature students, even of their own language, prematurely offering themselves for an examination in so special a subject as Physiology." He gives lists of their numerous errors in spelling and in the use of scientific terms, and speaks of the "inaccuracies, the confusion of thought and expression, and the bad grammar, punctuation, and orthography, illustrated by the examples of errors" given by him.

XIX.—Domestic Economy.

Examiner.—**The Very Rev. Richard Dawes, Dean of Hereford.**

Questions for Male and Female Candidates.

96. Domestic Economy being mainly based on the applications of Chemistry and Physiology, both male and female candidates will be required to show an acquaintance with the rudiments of these sciences. It should embrace the phenomena of nutrition, respiration, the functions of the skin, &c.; the rationale of lighting, warming, ventilating, cleaning, disinfecting, &c.; of cooking, preserving, &c.; and the origin and manufacture of household articles, as far as this may be necessary for a correct appreciation of their relative value for use, and for the detection of defective quality, adulteration, or fraud.

97. The essentials of a healthy and comfortable dwelling—clothing in relation to sanitary principles—food, animal and vegetable. Dietaries. Effects of stimulants and narcotics. Fuel and other household stores. Weights and measures. Keeping of household accounts.

Questions for Male Candidates only.

98. Materials and appliances involved in the construction of dwellings. Co-operative Building and Investment Societies. Mutual Provident Societies for various purposes. Savings Banks. Present and deferred annuities.

Questions for Female Candidates only.

99. The management of infants. The care of the sick, &c.

100. Text Books:—For Introductory Scientific Knowledge:—Laws of Matter and Motion (Chambers' Educational Course) (*Chambers*). Mechanics of Familiar Things, by Thomas Tate (*Longmans*). Experimental Chemistry, by Thomas Tate (*Longmans*). Physiology for Schools, by Mrs. C. Bray (*Longmans*). For Domestic Economy in general:—A Manual of Domestic Economy, by Tegetmeier (*Home and Colonial School Society*). Household Economy, by Margaret Brewster (*Constable and Co.*). Domestic Economy (Gleig's School Series) (*Longmans*).

XX.—Political and Social Economy.

Examiner.—Charles Neate, Esq., M.A., M.P., late Professor of Political Economy in the University of Oxford.

101. The examination will be devoted to the study of Civil Government and Social Economy, as set forth in the 3rd and 4th books of Stephens' Commentaries on the Laws of England. N.B.—In order to meet the question of expense as regards this work, candidates are informed that the earlier editions, which are obtainable at a reduced price, may be used, so long as they are not earlier than the 3rd edition.

102. Professor Fawcett's Manual of Political Economy must be studied by those who desire to obtain first-class certificates.

XXI.—Geography.

Examiner.—Wm. Hughes, Esq., F.R.G.S., Professor of Geography in King's College, London.

103. Candidates must show a sound knowledge of Elementary Geography, physical and descriptive. Such knowledge must embrace an acquaintance with at least the outlines of the great natural features of the globe, the political divisions of countries, and the localities of towns and other places of importance. This knowledge will be looked for in fuller extent with regard to the British Islands, and the various portions of the British Empire, than with regard to other countries. The growing importance of the colonial and foreign dependencies of Britain renders a knowledge of their geography now more than ever necessary. The Australian colonies, New Zealand, and British India, are hence proposed as subjects for more especial study on the part of the intending candidates for the ensuing year's examinations, and their attention is directed to them accordingly. In evidence of the knowledge possessed regarding those regions, the candidate will be required to sketch, from memory, a map of any one of the Australian colonies that may be named by the examiner. Such sketches need not possess accuracy of detail, but should at least show the general direction of coast-lines, mountain-chains, or river-courses, with the localities and names of the principal towns.

104. Candidates who aim at the highest class of certificate should be also prepared to answer such questions upon Geography in its relation to the Physical Sciences and the History of Mankind, as involve a general acquaintance with the subject of Climate, the laws of Meteorology, the Distribution of Plants and Animals over the Globe, the leading outlines of Geology, the Ethnographic Division of the Human race, and the commercial resources of different lands. This kind of knowledge is looked for, not in place of geographical knowledge of a more elementary kind, but as supplementary to it, and throughout based upon it.

105. Text Books:—Manual of Geography, by William Hughes (*Longmans*). Geography of British History, by William Hughes (*Longmans*). Guyot's Earth and Man (*Parker and Son*). Page's Introductory Text Book of Geology (*Blackwood*). The School Physical Atlas (*either Johnstone's, Philips's, or that published by the National Society*).

XXII.—English History.

Examiner—(Will be appointed.)

106. English History and English Constitutional History. Text Books:—The Student's Hume. Creasy's Rise and Progress of the English Constitution.

107. Special subject:—The reigns of John and Henry III. Text Books:—Lingard; and Blaauw's Barons' War.

108. The Examiner repeats the suggestion made last year "that candidates should practice themselves in answering questions on papers for their tutors from time to time."

XXIII.—English Literature.

Examiner.—Rev. Samuel Clark, M.A., *Chairman of the Board of Examiners.*

109. Any two, but not more than two, of the authors in the following list may be taken up for examination:—

Chaucer.—The Prologue to the Canterbury Tales.
Shakspeare.—King Lear; Richard III.; As You Like It.
Bacon.—Essays.
Trench.—On the Study of Words.

110. Candidates are recommended to make a very careful study of the text of the authors they may select. The questions on each author will be divided into two sections, the first intended to test the candidate's acquaintance with the text, the second his knowledge of the subject-matter and his critical and literary information. Full marks will not be given for answers in the second section, if those in the first section do not prove satisfactory.

111. The Examiner, referring to the last examination, says:—"Two or three of the candidates have wasted their time in making imperfect, though tedious, grammatical analyses of the passages contained in the questions," He adds:—"It should be understood that no marks can be given for anything beyond an answer to the examiner's questions."

XXIV.—Logic and Mental Science.

Examiner.—J. D. Morell, Esq., LL.D., one of her Majesty's Inspectors of Schools.

112. Logic: Candidates will be expected to answer questions on the different processes of thought, and the symbols by which they are expressed. Every Candidate must be prepared to analyse examples of reasoning, and to detect fallacies.

113. Text Books:—Whateley's Elements of Logic, or Thomson's Outline of the Laws of Thought.

114. A Candidate for a second or third-class Certificate will be expected to prepare, in addition, any one of the following books which he may select:—Mill's System of Logic, Book III., of Induction; Sir James Mackintosh's Dissertation on the Progress of Moral Philosophy; or a Manual of Moral Philosophy, by W. Fleming, D.D. (Glasgow). Brown's Lectures on the Philosophy of the Human Mind (first 50 Lectures), or Sir W. Hamilton's Lectures on Metaphysics.

115. A Candidate for a first-class Certificate will be expected to prepare any two of these works which he may select.

XXV.—Latin and Roman History.

Examiner.—Rev. F. Temple, D.D., Head Master of Rugby School.

116. Livy, Book I. Virgil; Georgics, Book IV.

117. Roman History to the death of Augustus Cæsar. Text Book:—Liddell's History of Rome, in one volume.

XXVI.—French.

Examiner—Alphonse Mariette, Esq., M.A., Professor of French, King's College, London.

118. The Examination paper will be divided into three parts.

119. The first will comprise grammatical questions and an extract from a modern French writer, to be translated into English. Candidates merely aiming at a 3rd class certificate should confine themselves to this first part.

120. The second part will comprise, together with a few grammatical questions, an English extract to be translated into French, and a list of idiomatic expressions to be rendered from French into English, or *vice versâ*. This should be done satisfactorily by the candidate who aims at a 2nd class certificate.

121. In the third part, candidates for a 1st class certificate will have to translate an English extract into French (to which great importance is attached), and to answer properly (*in French*) some *elementary* questions on the two following subjects:—

1. French literature during the reigns of Louis XV. and Louis XVI.
2. The History of France, from the Treaty of Aix-la-Chapelle, to the Revolution (1748 to 1789).

122. Books recommended:—Mariette: Half-Hours of French Translation (*Williams and Norgate*, London and Edinburgh). Nisard: Histoire de la Littérature Française, vols. 3, 4 (*Williams and Norgate*). Duruy: Histoire de France, vol. 2 (*Williams and Norgate*).

XXVII.—German.

Examiner.—Dr. Wintzer, Teacher of German in King's College, London.

123. The examination paper will consist of three sections. The first will contain extracts or questions from the works recommended for reading; the second grammatical questions and idioms; and the third English phrases; an extract from an English author (both to be turned into German); questions on a certain period of the history and literature of Germany; and a theme to be worked out in German.

124. Each Candidate must translate at least one of the extracts in section 1. First-class Certificates will be given to those only who translate well from English into German, answer in German the few questions on the literature and history of Germany, and write a well-expressed essay on a subject which will be announced to them when they come up for examination.

125. Books recommended:—*Schiller's* Abfall der Niederlande (2tes u. 3tes Buch), Wilhelm Tell; *Goethe's* Tasso; *Kohlrausch's* Deutsche Geschichte (Vierter Zeitraum), and Vilmar's Geschichte der deutschen National-Literatur (Alte Zeit, dritte Periode vom Jahre 1517—1624).

126. The Examiner, referring to last year's candidates, says:—"Some of those who have written the essay sometimes deviate from the point in question. A stricter keeping in view of the subject to be handled, and a more logical method of arranging the matter, ought in future to be aimed at."

XXVIII.—Italian.

Examiner.—Signor V. Pistrucci, Professor of Italian in King's College, London.

127. Candidates for first-class certificates will be required to translate into English selections from the following works:—Dante, L'Inferno; Petrarca, Trionfo del Tempo; Tasso, La Gerusalemme Liberata; Alfieri, Saul and Filippo; Monti, Cajo Gracco. They must also translate into Italian an extract from some English author; answer some grammatical questions; and give the proper or approximate English equivalents for a certain number of Italian idioms.

128. Candidates for second and third-class certificates will be required to translate into English selections from the following modern prose writers—Foscolo, Botta, and and Manzoni; and to answer some grammatical questions.

XXIX.—Spanish.

Examiner.—B. B. Aguirre, Esq., Lecturer on Spanish in King's College, London.

129. Candidates for a first-class certificate will have to translate an English passage into Spanish, to render into English or French several idiomatic phrases, and to write in Spanish a short essay.

130. Candidates for a second-class certificate will have to translate from English into Spanish, and to answer several questions upon the Spanish verbs.

131. Candidates for a third-class certificate will have to translate from Spanish into English, and to answer several grammatical questions.

132. Books recommended:—Spanish Gil Blas; Conquista de Mejico, por Dn. Jose Morales Santistevan; Trozos escojidos delos mejores hablistas espanòles, por Dn. Carlos Ochoa; Estudios filolójios, por Dn. Manuel Martinez de Morentin.—Don Quixote translated into English by Charles Jarvis, Esq.

133.—The Examiner, referring to the last examination, says:—"Most of the candidates have tried for a higher certificate than their knowledge of Spanish seems to warrant, and a few only have complied with the requirements."

XXX.—Freehand Drawing.

Examiner.—F. S. Cary, Esq.

134. In freehand drawing the Candidate will be required to show a practical knowledge of the principles usually applied in the imitation of natural and artifical forms, such as furniture, manufactured articles, ornament, foliage, and the human form.

XXXI.—Geometrical Drawing.

Examiner.—Thomas Bradley, Esq., Professor of Geometrical Drawing in King's College, London, and of the Royal Military Academy, Woolwich.

135. Practical Geometry, or Geometrical Drawing, required by the Mechanist, Engineer, Builder, and all in any way employed in the arts of construction. The Candidate will be examined in Practical Plane Geometry, the construction of right line figures of given areas, and of curved lines required in the arts, &c.,; in Practical Solid Geometry, Elementary Problems on the line and plane, in space, and their combinations, the representation by orthographic projection of simple solids from conditions, and in the principles of Development as used in the construction of Maps, &c.; and in the Elementary Perspective Projection as far as it is required by the Architect.

136. Text Books:—Geometry, Plane, Solid, and Spherical (*Library of Useful Knowledge*) is especially recommended as a work to be studied on Theoretical Geometry.—Elements of Geometrical Drawing, published by the Committee of Council on Education, 2 parts (*Chapman and Hall*).—Hall's Elements of Descriptive Geometry for Students in Engineering. Heather's Descriptive Geometry. Also the following French Works:—Elémens de Géométrie Descriptive, par S. F. Lacroix; Traité de Géométrie Descriptive, par Lefebure de Fourcy; Nouveau Cours raisonné de Dessin Industriel, par Armengaud, aîné, et Armengaud, jeune, et Amouroux; Bardin's Works on Descriptive Geometry.

137. The Examiner, speaking of those candidates who failed on the last occasion, mentions the apparent causes of these failures as—"1st. A neglect of the conditions of the questions, either arising from carelessness in reading them, or from misconception of their import; 2. Neglect of the repeated injunction not to attempt more than the prescribed time allows of being carefully and thoughtfully accomplished; 3. A want of knowledge of the elements of solid or co-ordinate geometry, causing a great loss of time by compelling the candidate to adopt complicated and circuitous constructions instead of the brief and simple ones based on sound elementary knowledge."

XXXII.—Theory of Music.

Examiner.—John Hullah, Esq.

138. Notation, the modern modes, intervals, time, signatures, the stave, transposition, modulation, terms, and characters in common use.

139. The Elements of Harmony.

140. Musical History and Biography.

141. Arrangements must be made, in the Previous Examinations by the Local Boards, to test Candidates, by oral examination, in their knowledge or appreciation of the *sound* of musical successions and combinations. A form of the test to be used for this purpose by the Local Board at the Previous Examination, will be sent by the Council to such Local Boards as may *apply for it*, in due time before the Examination.

142.—The Examiner, referring to the last examination, says:—"Of the few candidates who have not passed, the failure is attributable (as on former occasions) to their having attempted the harmony and counterpoint questions with insufficient or no preparation, to the neglect of those questions which possibly they might have answered correctly."

PRIZES FOR 1866.

THE PRINCE CONSORT'S PRIZE.

143. His Royal Highness the late President of the Society was pleased to offer annually to the candidate who, obtaining a certificate of the first-class in the current year, shall have obtained in that year and the three years immediately preceding it, the greatest number of such certificates, a PRIZE of TWENTY-FIVE GUINEAS, and this Prize Her Majesty the Queen has graciously intimated her intention to continue. This Prize cannot be taken more than once by the same candidate. It will be accompanied by a certificate from the Society of Arts, setting forth the special character of the Prize, and the various certificates for which it was granted.

144. In addition to the Prizes in Botany offered by the Society of Arts to candidates taking certificates of the First Class, the Council of the Royal Horticultural Society offers three additional Prizes of £5, £3, and £1 respectively to the three candidates being *bonâ fide* professional Gardeners, who, taking any grade of certificate in Botany, obtain the highest number of marks in that subject.

145. In addition to the Prizes in Floriculture, and in Fruit and Vegetable Culture, offered by the Society of Arts to candidates taking certificates of the First Class, the Proprietors of the *Gardener's Chronicle* offer three additional Prizes of £3, £2, and £1 respectively, for the three candidates, being *bonâ-fide* professional Gardeners, who, obtaining a Second-class certificate, at least, in Floriculture, or Fruit and Vegetable Culture, shall obtain the highest number of marks in one of these subjects, and also a Second-class certificate, at least, in Book-keeping or Mensuration.

GENERAL PRIZES.

*** None of these Prizes will be awarded to a Candidate who does not obtain a Certificate of the first-class in the subject.

1. Arithmetic	First Prize, £5. Second Prize, £3.
2. Book-keeping	First Prize, £5. Second Prize, £3.
3. Algebra	First Prize, £5. Second Prize, £3.
4. Geometry	First Prize, £5. Second Prize, £3.
5. Mensuration	First Prize, £5. Second Prize, £3.
6. Trigonometry	First Prize, £5. Second Prize, £3.
7. Conic Sections	First Prize, £5. Second Prize, £3.
8. Navigation and Nautical Astronomy	First Prize, £5. Second Prize, £3.
9. Principles of Mechanics	First Prize, £5. Second Prize, £3.
10. Practical Mechanics	First Prize, £5. Second Prize, £3.
11. Electricity and Magnetism	First Prize, £5. Second Prize, £3.
12. Light and Heat	First Prize, £5. Second Prize, £3.
13. Chemistry	First Prize, £5. Second Prize, £3.
14. Mining and Metallurgy	First Prize, £5. Second Prize, £3. Additional by Gift of Sir Thomas Phillips, F.G.S:— Third Prize, £2; and Three Prizes of Books, value £1 each.
15.*Botany	First Prize, £5. Second Prize, £3.
16.*Floriculture	First Prize, £5. Second Prize, £3.
17.*Fruit and Vegetable Culture	First Prize, £5. Second Prize, £3.
18. Animal Physiology (in relation to Health)	First Prize, £5. Second Prize, £3. Additional by Gift of Harry Chester, Esq.:— Third Prize, £2; and Three Prizes of Books, value £1 each.
19. Domestic Economy	First Prize, £5. Second Prize, £3.
20. Political and Social Economy	First Prize, £5. Second Prize, £3.
21. Geography	First Prize, £5. Second Prize, £3.
22. English History	First Prize, £5. Second Prize, £3.
23. English Literature	First Prize, £5. Second Prize, £3.
24. Logic and Mental Science	First Prize, £5. Second Prize, £3.
25. Latin and Roman History	First Prize, £5. Second Prize, £3.
26. French	First Prize, £5. Second Prize, £3.
27. German	First Prize, £5. Second Prize, £3.
28. Italian	First Prize, £5. Second Prize, £3.
29. Spanish	First Prize, £5. Second Prize, £3.
30. Freehand Drawing	First Prize, £5. Second Prize, £3.
31. Geometrical Drawing	First Prize, £5. Second Prize, £3.
32. Theory of Music	First Prize, £5. Second Prize, £3.

* For extra prizes in these subjects see above.

LOCAL EDUCATIONAL BOARDS.

The following is a List of the places at which Local Boards have already been formed, with the names of the Secretaries, from whom intending Candidates and others may obtain information relative to the Examinations:—

Local Boards.	Secretaries.
Aberdeen	Mr. James Sinclair, Mechanics' Institution, Aberdeen
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Bradford	Mr. James Simpson, Mechanics' Institution, Bradford
Brighton (for Sussex	Mr. Barclay Phillips, 75, Lansdowne-place, Brighton.
Bristol	Mr. F. W. Cross, Athenæum, Bristol.
Bury St. Edmund's	Mr. John Jackson, Head Master of the Commercial School, Bury St. Edmund's.
Canterbury	Mr. W. D. Furley, Canterbury.
Carlisle Mechanics' Institute	Mrs. Jane Williamson, Mechanics' Institute, Carlisle.
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Chelmsford	Mr. W. Cutts and Mr. Jesse Garrood, Chelmsford.
Darlington	Mr. F. T. Steavenson, Darlington.
Deptford	Mr. T. Earland, 2, Wellington-grove, Greenwich-road.
Derby	Mr. H. M. Holmes, Hon. Local Sec. to the Society of Arts, London-road, Derby.
Devonport	Mr. W. Mogg and Mr. Samuel Chapple, Mechanics' Institute, Devonport.
Faversham	Mr. Frederick W. Monk, Managing Director of the Faversham Institute.
Gilford (Ireland) Young Men's Mutual Improvement Society	Dr. Henry McBride, M.D., Gilford, Co. Down, Ireland.
Glasgow Athenæum	Mr. John Allan, 13, Queen-street, Glasgow.
Glasgow Institution	Mr. John Craig, F.E.I.S., Glasgow Institution, 37, Cathedral-street, Glasgow.
Glasgow Mechanics' Institution	Mr. J. McDougall, 27, Stanhope-street, Glasgow.
Glasgow Popular Evening Classes, Andersonian University	Mr. Geo, Martin, 11, Gt. Western-road, Glasgow.
Gosport and Alverstoke Lit. and Sci. Institution	Mr. William Short, 56, High-street, Gosport.
Greenwich	Mr. Jas. Spencer, 3, Wintown-place, Greenwich, S.E.
Halifax Working Men's College	Mr. Geo. Gibb, Haley Hill, Halifax.
Hartlepool (West)	Mr. Thos. Preston Brunton, and Mr. John Thomas Belk, Solicitors, West Hartlepool.
Hastings and St. Leonard's	Mr. J. C. Savery, 27, Marina, St. Leonard's.
Hertford	Mr. J. L. Foster, Hertford.
Hitchin	Mr. Joseph Pollard, High-down, near Hitchin.
Hull	Mr. P. Blackmore, Young People's Institute, Hull.
Ingro-cum-Hainworth	Mr. Jackson, Ingrow-cum-Hainworth.
Ipswich	Mr. Edwin Barrett, 31, Cornhill, & Mr. Herbert Wright, 44, Handford-road, Ipswich.
Knutsford	Mr. G. W. Clarke.
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,, Haslingden	Mr. J. Binns, Haslingden.
,, Rawtenstall	Mr. T. Thomas, Rawtenstall.
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,, Lambeth	Mr. T. Heller, Hercules'-buildings, Lambeth, S.
,, Mechanics' Institution	Mr. T. A. Reed, 41, Chancery-lane, W.C.

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,, Notting-hill...	Mr. T. Timson, James-street, Notting-hill, W.
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,, Pimlico.........	Mr. C. Thompson, Pimlico Literary Institution, Winchester-street, Pimlico, S.W.
,, St. James's, Westminster	Mr. Joseph Randall, 45, Marshall street, Golden-sq. W.
,, St. Stephen's, Westminster	Mr. J. Cawood, St. Stephen's School, Westminster.
,, St. Thomas, Charterhouse, Evening Classes....................	Mr. G. Phillipson, St. Thomas' Charterhouse School.
,, Spitalfields and Bethnal-green	Mr. T. N. Day, Abbey-street School, Bethnal-green, N.E.
,, Stepney Deanery	Mr. W. F. Ives, St. John's School, Limehouse.
Louth	Mr. Benjamin Crow, Mechanics' Institution, Louth.
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Newcastle-on-Tyne, Mechanics' Institution......	Mr. Adam Carse, 18, Mosley-street, Newcastle.
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Oldham Science School...	Rev. Wm. Walters, Middleton-road, Oldham.
Paisley	Mr. Charles Dalton Wason, Teacher, St. George's School, Paisley.
Pembroke Dock	Mr. T. H. Eastlake, H.M. Dockyard, Pembroke Dock.
Peterborough	Mr. C. T. Cotton, Long-causeway, Peterborough.
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,, Dudley	Mr. J. Stokes, Solicitor, Dudley
,, Handsworth ...	Mr. G. D. Boyle.
,, Kinver	Mr. T. Bolton.
,, Pensnett	Rev. C. J. Atherton, Pensnett, near Dudley.
,, Smethwick ...	Mr. F. Talbot, Messrs. Chance's Library, Smethwick.

South Staffordshire Union:—

,, Stourbridge ...	Rev. J. W. Grier, Amblecote.
,, Walsall	Rev. A. C. Irvine.
,, Wednesbury...	Mr. C. Britten.
,, West Bromwich........................	Rev. J. Whewell.
,, Willenhall ...	Mr. J. Bennett.
,, Wolverhampton	Mr. J. N. Langley, Mowbray House, Wolverhampton.
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Woolwich	Mr. W. D. Keeble, Royal Laboratory, Woolwich.
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,, Halifax Mechanics' Institution......	Mr. A. C. Foster, Solicitor, 1, Westgate, Halifax.
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,, Holbeck.........	Mr. Geo. Tinker.
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,, Keighley	Mr. C. D. Hardcastle, Keighley.
,, Leeds, Mechanics' Institution ...	Mr. J. O. Dayson.
,, ,, West Riding Educational Board......	Mr. Barnett Blake.
,, Middlesbro'-on-Tees	Mr. W. Taylor, Mechanics Inst., Middlesbro'-on-Tees.
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,, Otley............	Mr. H. J. Newstead.
,, Queensbury ...	Mr. W. V. Quarmby.
,, Reeth	Mr. W. Wilkie.
,, Rotherham ...	Mr. W. Unwin, Currier, Rotheram.
,, Scarborough ...	Messrs. Thos. Shields and J. Edmond, Mechanics' Institute, Scarborough.
,, Slaidburn (Clitheroe)	Rev. D. Jones, Slaidburn.
,, Stocksbridge (Sheffield)	Mr. H. Robertshaw, Stocksbridge.
,, Stockton-on-Tees	Messrs. T. W. Hornsby and T. Ainsworth, jun.
,, Thirsk	Mr. J. G. Baker, Market-place, Thirsk.
,, Wilsden (near Bradford)	Mr. C. Petty, Wilsden.

The foregoing Programme of Examinations is published in a separate form, and may be had gratis, on application to the Secretary of the Society of Arts; a copy will be forwarded to each Institution and Local Board.

Proceedings of Institutions.

Glasgow Institution.—From the last report it appears that the number of students and scholars attending the classes during 1864-65 was 894, being an increase of 48 over the previous year. That of these the number attending the various classes was as follows:—Mathematics, 27; free-hand drawing, 37; mechanical drawing, 33; practical mechanics, 36; Latin and Greek, 36; French, 67; grammar, composition, and logic, 77; arithmetic and book-keeping, 124; writing, 32; geography, 3; morning classes, 16; phonography, 13; elocution and English literature, 33; elementary evening classes, 99; ladies' evening classes, 40; dancing, 25; and in the juvenile day classes—Middle, 190; lower, 92; advanced, 16; ladies, 4; free-hand drawing, 92; needlework, 14. That 36 came forward to the preliminary examinations of the Society of Arts, of whom 27 passed, but several were under age. Of the juveniles, 58 came forward to the examination of the Local Board; of them 53 passed, and were awarded 16 first-class certificates, 16 second, and 21 third. The following certificates were awarded in the students' classes:—Practical mechanics, 2; elementary arithmetic, 5; arithmetic, 8; writing and its applications, 9; free-hand drawing, 10; book-keeping, 8; Latin, 2; English grammar and composition, 2; logic, 3. The directors have been obliged to give up the premises they have occupied for the last four years, on account of the heavy rent, and consequent expenditure necessary to maintain the Institution, and have removed to the premises it formerly occupied in 63, Cathedral-street. The income for the last two years has been only about £300—this year £302 7s. 6d., and last year £303 1s. 11d., which could not afford £130 a year for rent and standing expenditure at the fees charged; while the raising of the fees would introduce an entirely different class of students for whom ample accommodation is provided in other places in the city; the change of premises has therefore been resorted to. The report concludes by expressing thanks to the Local Board and to Alex. Craig, Esq., artist, London, for his able representation of the Institute at the Society of Arts Conference.

NORTH-EASTERN LONDON EXHIBITION OF ARTS AND MANUFACTURES.

The opening ceremonial of the above exhibition took place on the 16th instant, at the Agricultural Hall. The Organ-gallery was occupied by Mr. G. W. Martin's choir, augmented for this occasion to a thousand choristers.

The Lord Chancellor arrived at three o'clock, accompanied by the Marquis of Salisbury. At the same time came also the Lord Mayor, attended by Alderman and Sheriff Besley and the usual civic retinue. The Archdeacon of London was also present on the platform, with a great number of the manufacturers and employers of the district. The Lord Chancellor was received on his arrival by Mr. King, the chairman of the Committee, and his colleagues, and conducted to the dais, where the simple ceremonial of the day immediately commenced. A procession was formed, including the Lord Chancellor, the Marquis of Salisbury, the Lord Mayor, and the members of the committee, and a complete circuit and careful examination made of the exhibition. After which, on returning to the dais, prayer was read by Archdeacon Hale, and the Lord Chancellor, at the request of the Lord Mayor, declared the exhibition opened. The next proceeding was the singing by the choir of the chorale composed by the late Prince Concert—"Awake my Glory."

The Lord Chancellor addressed a few words to the company. He had, he said, when first asked to preside on that occasion, expressed, in all sincerity, his doubts of his fitness for the task; but subsequently, when he remembered how few of our leading personages were in town at this season of the year, he determined, however reluctantly, to accede to the request of Mr. King. Most of them who heard him were old enough to remember the Exhibition of 1851, which owed its existence to the practical wisdom and judgment of the late Prince Consort. He (Lord Cranworth) must confess that at first he was not very sanguine as to the success of that exhibition, but the result showed how much England and the world were indebted to the illustrious individual with whom it originated. At intervals of four and eleven years that exhibition was imitated by our neighbours across the channel, and then the illustrious originator of the 1851 Exhibition approved the plan of that of 1862. Providence in its inscrutable wisdom prevented his royal highness from witnessing the triumph of this work, but one result was the establishment on a more extended basis of the Kensington Museum—in his judgment a most valuable institution, as enabling the working man to study the best models in the finer mechanical arts. However, it was idle to suppose that the 300,000 working men living in the north-east of London could go to Kensington; indeed, a calculation has been handed to him showing that four visits to Kensington would cost the working man equivalent to two-and-a-half days of his working time. Such being the case, it had been suggested that greater facilities for art studies might be given by the establishment of local museums, and it was the proud distinction of the district in which he then stood that it had taken the initiative in this most important movement. Amongst its population were the makers of horological, philosophical, and photographic instruments; and it was most desirable that they should have within reach such a museum as it was hoped now to establish. In fact, it was an indispensable sequence to free trade; for if we permitted foreign workmen to come in and compete in the English market, it was only fair that the English workman should have the means of studying, and of surpassing, if possible, the points in which his foreign competitor beat him. This could only be done by collecting in a museum specimens of all the artistic workmanship of the world; and, therefore, he trusted the time was not far distant when they would have to open such a collection on the spot where he stood. Another advantage of such a museum, as well as of similar institutions, would be to promote habits of temperance amongst working-men. He was old enough to remember when habits of intemperance were considered to be no disgrace in the very highest ranks of society, whereas now they were completely exploded. He hoped to see similar results amongst working men; but what would lead to them would be, not repressive laws, but the institution of establishments like the present, which would amuse whilst they instructed, and would have the effect of rendering temperance attractive. After one or two further observations, his lordship concluded his address with a Scriptural quotation illustrative of the dignity of labour.

The Marquis of Salisbury followed with a brief expression of thanks to his lordship for presiding, and the proceedings terminated with the National Anthem, sung in full chorus by the entire company.

PARIS UNIVERSAL EXHIBITION OF 1867.

A new feature has appeared in connection with this Exhibition, namely, the introduction of the literary or rather scholastic element. It has not yet taken any definite shape, but it is shadowed forth in a speech delivered by the Minister of Public Instruction, on the occasion of the presentation of the annual prizes to the pupils of the Lycées and Colleges of Paris and Versailles on the 7th instant. M. Duruy says:—

"In eighteen months, the nations will come here from the extremities of the earth to dispute for the palms of peace. A place in that competition will be reserved for you.

"As France will show what she is able to do in industry and arts, it is not right that the University should stand out of that great combat. Let us set forth our education in the full light of day, and in seeing the wise and intelligent direction under which you are placed, the world will recognise, in her tranquil but confident course, the *Alma Mater* that has borne so many generations on her fruitful bosom. I warn you, then, future laureats of the great competition of 1867, that your works, whatever they may be, will be sent to the Committee of the Universal Exhibition. If Germany, England, Italy, and the other powers will do the same, and on the same conditions, we shall see who is in the best course. It is the saying of one of us, of that Gaul mentioned by Livy, who defied the bravest of the Roman army—*Ostendat eventus quæ gens* * * * *Sit melior.*

"The lists are prepared; the prize is ready—for the most worthy! In the spirit of the invocation to the young heroes in ancient times, I say, 'Forward! for the honour of the University and of France.'

"To you, professors and illustrious scholars who surround me, I have something more to say. While the immense edifice is being erected within which are to be collected all the marvels of industry, the Emperor desires to see raised by foreign and able hands another monument, to be occupied by the very genius of France. Sciences, arts, and letters, telling their own progress and history during the last twenty years, showing the theories which they have put forth; the ideas to which they have given birth; the facts which they have discovered and illustrated; the new forms which imagination and art have inherited, in a word, what France has thought set side by side with what she has done, the work of her intellect as well as that of her hands; this will be a grand spectacle, full of interest as regards the past, and full of promise for the future; for the future relies on the past, in order to raise itself still higher, and cannot make good use of the support without well comprehending it.

"Let other nations follow our example in this, and the moral exhibition will be as valuable as the material one, and have the same happy consequences.

"Although language gives in each country a different form to thought, beneath these diversified dresses are the ideas which compose the common stock from which all humanity draws. Has this stock of ideas increased or diminished during the last twenty years? This we shall learn, and the world will thereby see what direction its efforts ought to take for the future. Remember that it was at the Olympic games that the genius of Greece was formed.

"I trust that this appeal to the world, going forth from the bosom of the University of France, may be successful; but, come what may, let us do our duty.

"To work, then, gentlemen! Hasten the completion of what you have in hand, or commence some new labour, in order, if possible, to add another leaf of gold to that crown of honour which, in this moral competition, is, I hope, reserved for France."

The idea is novel; the appeal is a bold one, and it is for the educated world to consider how intellect can take her place amongst the competitors of the Olympic games of 1867.

COLONISATION; ITS ASPECTS AND RESULTS.

By William Stones, Esq.

(*Continued from page* 598.)

Religion.

A review of our colonial system would be incomplete without a notice, however slight, of its bearing upon the religious institutions of the mother country. Most emigrants retain a regard to those religious observances which are to some extent, perhaps, peculiar to this country, hence the Sunday is generally as much regarded, and, I think even more so, than at home as a day of absolute rest from toil. At first one of the settlers may have religious services in his own house, then a special room is obtained and fitted up, next a weather-boarded and shingle-roofed church or chapel is reared, afterwards the extravagance is committed of erecting a brick or stone edifice, and lastly, as the colony progresses, a cathedral church rises in ambitious proportions, built in all sympathetic recollection of the time-honoured, hallowed fanes of the mother country, and anticipations of future colonial glory. Whatever our special religious opinions may be, from a broad point of view it cannot be questioned that the presence of a number of ministers, educated gentlemen from the universities of the old country, married to wives in whom are combined domestic virtue and refinement, is a great advantage to the colonists. The colonial bishops and their clergy not only constitute fresh centres of religious and intellectual activities, but the bishops being recognised heads through whom the moral wants of the colonial dioceses can be definitely and forcibly brought before the home church, assistance is thus more readily obtainable for the various matters within the range of church action.

The objects of this paper do not permit my entering into details, and therefore I must abstain from more than a mere reference to the operations of the Society for the Propagation of the Gospel in Foreign Parts, the Church Missionary Society, and kindred institutions, some devoted exclusively to the colonies, while others include the colonies in their general working. Nor are the communities outside the Church less energetic than the Establishment; the Wesleyan, London, and Baptist Missionary Societies, all devote great attention to our colonies, several of these bodies having special associations for colonial objects; and in the utmost recesses of her Majesty's dominions the earnest pastors of each and all of the religious communities may be found zealously attending to the spiritual and moral needs of their charges. Circumstances frequently induce or require some of these educated men to devote a portion of their time to the instruction of youth, thereby enabling the children of colonists to become acquainted with learning of a character which otherwise would not be possible in their peculiar and scattered position. And it may here be remarked, to the honour of our colonies, that without exception no money is so readily and unanimously voted as the funds required for introducing educated men as professors and teachers, and carrying out the great principle of educating the children of colonists of every grade. Nor should it be overlooked that in the absence of hospitals, dispensaries, and with medical men sometimes resident at a great distance, the medicine chest and the intelligent advice of the minister are frequently of great service to settlers.

Travelling in a dense forest is always impressive, but most intensely so when camping out on the Sunday. One listens in vain, in the deep solemn silence, for the once familiar "sound of the Church-going bells," and all day long is silence, ever silence. Many a time have I strained the ear to catch again in imagination the dear sound of Saint Saviour's bells, whose sweet peals so oft on Sunday mornings came wafted adown the silent river, making soft and pleasant music to me when a boy in the old home of my father. I envy not him who can hear without emotion the simple tolling of the bell for service in some little backwood settlement, or the well-known strains arising from assembled worshippers, of the Morning Hymn or the Old Hundredth Psalm.

Amusements.

It would be quite impossible within our prescribed limits to do more than barely call attention to the fact that the national love of hunting, shooting, yachting, rowing, fishing, racing, gratifies and expends its humour in every part of the world.

Fiords in the extreme of Norway are leased for fishing; African elephants fall by the guns of British sportsmen; and the Indian tiger is brought low by the English rifle; now a crew row a boat all through the rivers of

Europe; and anon a solitary countryman writes a note from the source of the Nile. It might, therefore, be expected that among colonists, who are so frequently thrown upon their own resources, and are naturally very self-reliant and confident, athletic sports would find great encouragement. We note but one or two.

Racing.—Wherever Frenchmen land a café is opened, wherever Englishmen go a racecourse is arranged, and horse races become an institution of the smallest settlement. By these periodical assemblages a spirit of emulation is kept up amongst colonists, the importation of horses of good breed is encouraged, and the mother country is advantaged by the continued demand for horses of repute and character. Some of the highest prices realised at the sales of English horses are paid by colonial buyers, and in every colonial newspaper advertisements may be found relating to horses recently imported from England. In 1864 we exported 4,657 horses, valued at £230,831.

Cricketing.—This peculiarly English sport is planted in every colony, therefore it cannot depend upon climate; it must be in the race. You cannot make eleven German or French boys understand how such violent sustained exertion can be play or amusement; and yet, wherever English men or boys are, there is cricket. So strong is the love of this game that, within the last few years, a professional eleven have been invited, not only to Canada but to Australia, to exhibit their skill, and the speculation was so successful that a second party has since gone out. As another illustration, I may name that in a recent account of Singapore I find the author reports that the trade which in 1853 amounted to £5,000,000, in 1863 amounted to £17,000,000; and, although the European population is very small, some 800 only, they are noted for their wonderfully good dinners, not omitting plum-pudding on Christmas-day, and, he significantly adds, "they keep race-horses, and play cricket in a temperature of 82°." Perhaps their adhesion to athletic sports under trying circumstances may be accepted as an indication of the vigour the thriving community of Singapore throw into all their transactions.

Theatricals.—My remarks on this point will be limited to the presenting of two pictures in connection with the district of our youngest colony—Vancouver's Island. The first is an extract from Captain Cook's voyage, 25th April, 1778:—"The inlet in which our ships were moored is called by the natives "Nootka," but Captain Cook gave it the name of King George's Sound. As to the natives, their persons in general are under the common stature, their colour could never be determined positively, as their bodies were incrusted with paint and dirt. They wear a cap in shape of a flower pot, made of very fine matting, ornamented with a bunch of leather tassels, and having a string passing under the chin to prevent its blowing off. Besides their ordinary dresses the natives have some that are used only when going to war or exhibiting themselves to strangers in ceremonial visits. The most usual head-dress on these occasions is a quantity of withe wrapped about the head with large feathers. At the same time the face is variously painted, the upper and lower parts being of opposite colours, and the strokes having the appearance of large gashes; or it is besmeared with a kind of fat or tallow, somewhat like carved work. Thus equipped, their ridiculous appearance is heightened when they assume their monstrous decorations. These consist of a great variety of wooden masks applied to the face, forehead, or upper part of the head. Some of the visors resemble human faces, having hair, beards and eyebrows; others represent the heads of birds and various animals, as deer, porpoises, wolves, &c. Such kind of representations exceed the natural size, and are frequently strewed with pieces of mica, which makes them glitter, and augments their deformity. In these imaginary decorations they sometimes run into great excess, and fix large pieces of carved work upon the head projecting to a considerable distance, and resembling the prow of a canoe. Whether these grotesque masquerade ornaments were for diversion, religion, or intimidation, Captain Cook was uncertain. Sonnets were sung by single performers keeping time by striking the hand against the thigh; a rattle and a small whistle being the only instruments of music which we saw amongst them. The rattle is used when they sing." Here, then we have Vancouver's Island amusing itself in masquerade, music and song; struggling to vie with Rome in its carnival—the great globe between.

Had we visited Vancouver's Island in 1778 we should have been treated to a musical festival of a rattle and a whistle. Had it been our fortune to go thither in December, 1864, what kind of amusement would have been afforded us? I quote from the *Times* of the 18th February, 1865:—

"On the 12th December, 1864, those eminent artists, Mr. and Mrs. Charles Kean, commenced an engagement for six nights at the Victoria Theatre, Vancouver's Island, in the course of which they performed "Henry VIII.," "Louis XI.," "Hamlet," "Merchant of Venice," "Macbeth," "Othello," and "The Jealous Wife." After the termination of their engagement, which proved successful beyond expectation, the Mayor and members of the Council waited upon them at their hotel and delivered a complimentary address."

A rattle and whistle! Hamlet and Corporation thanks! How great the contrast!

Fine Arts.

Industrial Art Exhibition, Paris.—The doors of this first exhibition, got up by the new Société des Beaux Arts appliqués à l'Industrie, were opened, as promised, on the tenth instant, and when the objects are completely arranged the collection promises to be exceedingly interesting. The arrangements of the interior, due to M. Guichard, architect and president of the society, are in excellent taste, the most prominent feature being the new staircase which has already been mentioned in the *Journal.* This improved mode of connecting the body of the building with the galleries is achieved by the construction of two noble flights, of eighty stairs each, in four compartments, commencing at the sides of the west end of the Palais de l'Industrie, and meeting in a bold landing over the western door. The erection itself is in excellent taste, and is decorated with statues, busts, and other works of art. The outer sides of the staircase are also made available for the purposes of the exhibition. The collections are divided into three distinct categories—the Past, the Present, and the Future of Industrial Art. The first of these, the retrospective museum, occupies the western gallery, to which the new staircase directly leads, and will form a fine collection of the productions of bye-gone times. The Barons Rothschild have sent their rare enamels, majolica and Palissy ware, Italian furniture, cabinet and other objects from their residences in Paris and Ferrières; M. Henri Didier and M. Joseph Fau, a quantity of beautiful carved wood work; M. Double, a collection of Louis XVI. furniture; M. H. dela Salle, a fine series of antique bronzes; M. Dutuit, some remarkable triptyches and curious illustrations of horology; M. Basilewsky, his Byzantine museum; M. d'Yvon, a series of Florentine bronzes; Prince Czartorisky has placed the contents of the famous Hôtel Lambert at the disposal of the society, including old regalia of his regal house, his curious collections of saddlery and Polish tapestry; Baron Pichou contributes silver ware; Doctor Piogey, Chinese objects; Messieurs Pascal, Davillier, Maillet-Duboulay, Scheffer, de Monville and others, *faïences* of French, Persian, and other manufactures; M. de Nieuwerkerke, M. Saint Seine, and M. Spitzer, collections of arms; M. Lecarpentier, his celebrated museum of antique art of all kinds; M. Techner, some extremely fine historic book-binding; and other well-known amateurs, articles of various kinds. The body of the building is devoted to the actual

productions of the present day, and promises to present the best collection perhaps yet seen of modern French ironwork, castings, bronzes, gold, silver, and ornamental wares, porcelain, earthenware, furniture, carriages, sculptures in marble, wood, and other materials, terra-cottas, carpets, tapestry, and other products of industrial art. The third, or future, portion of the exhibition consists of the works of the schools of design, lycées, primary and other schools, and comprises an enormous number of drawings and sketches. This exhibition may be looked upon as a very important prelude to the greater one of 1867, and the society by which it is instituted is patriotically determined to do all it can to gain if possible for France a yet higher place than she has heretofore attained in industrial art. The intention and the friendly rivalry, which is one of its results, are honourable and excellent, and there is this satisfaction respecting such a struggle that, whoever may carry off the greatest amount of honours, all the world will benefit by the advance of each competitor. The field is one in which no dishonour can accrue, and the lottery one in which there are no blanks.

Luxembourg Gallery.—This gallery is closed at the present moment, for the purpose of hanging the pictures purchased by the Government at the last annual exhibition and during the past twelve months. This will afford an additional attraction to those who visit Paris this autumn.

The Meeting of the French and English Fleets.—M. Durand Brager, a well-known marine painter, has been commissioned by the Imperial Government of France to follow the manœuvres of the combined fleets at Cherbourg, Brest, and Spithead, and to record on canvas the most striking and interesting episodes of this grand naval assemblage.

Bronzes in France.—It appears that the bronze manufacturers of Paris have determined to give prizes for which their workmen may compete. They offer £32 for a sculptured work of art; and the same amount for a sculptured ornament; £64 for the best chiselled work; £20 for the best drawing; £24 to the founders who shall turn out the best work; £16 to the best turner; and £12 to the best fitter. There are likewise medals to be given, and "honourable mention" to be made of those who may distinguish themselves. Competitors must send in their works between the 10th and 16th of November next.

Manufactures.

Hardy Silk Worms.—The disease which has attacked the silk worms in all the silk-growing countries of Europe, and even in China, and upon which some remarks will be found in the *Journal* of the 30th of June in the present year, seems to have produced more ravage than ever this year. It made its first appearance in 1856, and attracted special notice from the Jurors of Class IV. at the Universal Exhibition of 1862. Even before that time experiments had been made towards the introduction of other worms than those which feed on the mulberry tree, and the subject has been pursued in France with much determination, and with fair promise of success. Worms have been introduced which feed on the castor-oil plant, jujube, oak, and *Ailanthus*—originally called, by mistake, in France, the *Vernis de Japon*, from the supposition that it was the tree from which the Japanese obtained the beautiful varnish which covers their lacquered and other ware. M. Guerin-Meneville, a distinguished naturalist, who obtained a medal for his exhibition of various worms and their products in 1862, and who has since established a publication entitled *Revue de Sericiculture Comparée*, in which all the experiments and improvements connected with the production of silk are carefully recorded, has given great attention to the subject, and has been aided in his work by the Acclimatisation Society of Paris, as well as by the Government. In a small house, situated on a waste piece of ground appertaining to the Imperial farm at Vincennes—or rather at Joinville-le-Pont, a station beyond Vincennes, on the same line of railway—M. Guerin-Meneville has reared and propagated several new and strange species of worms, and it was he who succeeded in obtaining the first specimen known to have been born in Europe of the gigantic moth of the *Bombyx Atlas* of India, mentioned in the *Journal* of the 4th instant. This splendid moth was unfortunately the only one which was hatched from larvæ obtained from the eggs received from India, so that this experiment of acclimatisation has been stopped for the present. The moth in question covers a space nearly two-thirds of the size of a page of the *Journal*, and cannot be much less than six inches across at the lower part, from the tip of one wing to that of the other, or under five inches in the other direction; its colours are brilliantly lighted up by metallic reflections, and near the tip of each wing is a mark which closely resembles the eye of the peacock's feathers. It is however the *Bombyx cynthia* or Ailanthus silk-worm, introduced into France by M. Guerin-Meneville in 1858, which has attracted most attention. It is now bred in several departments of France, in Italy, and in other countries, and seems to offer promise of the production of a new material of manufacture in England and Ireland. In the *Moniteur Universel* of the 6th of June this worm is announced as being perfectly acclimatised; and a list of the silk-worm rearers in the provinces who are prepared to supply considerable quantities of the eggs is appended. The ailanthus itself well deserves attention, irrespective of the worms which feed upon its leaves. It has been long known in America, and within a few years has become common in Paris and other parts of France. The extent to which its cultivation has been pushed in the last-named country will be seen by the fact that the Imperial Director of forests ordered, in 1863, no less than four tons of the seed. In fact, it would be difficult now to find a garden, "parc," "square," or pleasure-ground in or near Paris without the *Vernis de Japon*, and two, if not more, of the great Boulevards are planted with it exclusively. It is a showy tree, resembling at first sight the ash, but growing, when placed in good conditions, in a beautiful conical form, and exhibiting great freshness and a charming variety of colour in its foliage; it grows with extraordinary rapidity, and in any kind of soil; supplies good fuel, and its wood is said to compare favourably with that of the oak and the elm. The *Bombyx cynthia* or ailanthus worms are found to succeed out of doors better than under shelter. M. Guerin-Meneville says that the dew is necessary for their success; and he supplies this to the young worms, which he keeps within doors for a few days after they are hatched, on branches of the ailanthus placed in water, by means of a pair of bellows with a reservoir attached, which sends the water in a fine shower on the leaves. The worms seem quite indifferent to the changes in the weather; wind, rain, or frost apparently not injuring them; but of course the cocoon is produced more quickly in genial weather. At the present moment M. Guerin-Meneville has worms of the second family this year half grown or more. Experiments have been made with the ailanthus worms by several gentlemen in England, and doubtless evidence may be obtained from them as to the success both of the tree and the insect. M. Guerin-Meneville says that both flourish still better in the United Kingdom than in France. If this prove to be the case generally, the encouragement of the culture and education of the ailanthus and its consumer would be a great national benefit, especially as the greater part of the duties connected with silk rearing may be performed by women and children and persons of little physical power The silk produced is not of the fineness and beauty of China silk; on the contrary, it is dark in colour and somewhat coarse, like the Tussah silk of India; and, in consequence of the cocoon being open at one end, thus allowing the escape of the moth without difficulty, it

will not float on water like that of the true silkworm, and the silk cannot therefore be wound off in the same manner; and moreover the absence of the gummy matter prevents the filaments adhering to each other, so that at present it yields only what is called spun silk; but it is said that M. Aubenas, of Loriol, in France, has invented a method of winding it, which is now being put into practical operation. On the other hand, the ailanthus silk bleaches and takes dyes fairly, and thus promises in any case to be a very useful addition to our textile materials; and there is little doubt that manufacturers would soon find the means of bringing it into profitable employment either alone or mixed with other filaments. The best season for planting the ailanthus is now approaching, and therefore the time is opportune for the consideration of the subject.

Colonies.

Agricultural Society of New South Wales.—The Annual Exhibition of stock, cereals, and other produce, under the auspices of this association, took place in May, at the Upper Park, Parramatta. Excepting the entries of machinery and agricultural implements, of which there was a remarkable deficiency, the exhibits, in quantity and quality, exceeded expectations. Of imported and colonial-bred cattle there was a satisfactory show; and still more so of blood stock—of colonial-bred stallions, of imported and colonial-bred sheep (the latter being interesting as illustrating the progress of sheep farming in the county of Cumberland), and of pigs. The poultry was particularly noticeable, the Dorking and Poland fowls being most admired, and the other varieties being largely represented. The display of fruits and vegetables was not so perfect as that of former agricultural shows. Two specimens of sugar from Port Macquarie, exhibited by the Rev. E. Holland, together with one of arrowroot and of treacle, attracted much attention—the sugar being of excellent appearance and flavour. Among the extra exhibits was some carefully prepared specimens of silk, shown by Mrs. B. Lee, of Parramatta; preserved fruit, colonial cigars and salt.

Sugar in New South Wales. — A Maitland paper says that the new company formed to cultivate this product have taken up one hundred acres of land, and it is very probable that ere long that area will be considerably extended. They have two acres of cane growing, and it was reputed to be in a flourishing condition, more so than that in the same stage of growth on the Queensland plantation. This augurs well for the adaptability of this new product to the soil. By September next they will have fifty acres planted, and the other fifty will be ready by the ensuing year. The company also purpose to plant a quantity of sorghum as an experiment, to ascertain its sugar-producing qualities, though they believe that ultimately the sugar-cane will prove the most remunerative.

Paraffin Oil in New South Wales. — Much attention has been directed to the discovery of the mineral from which paraffin oil can be obtained. Extensive seams of this mineral are said to have been found in different parts of the colony—near Hartley, near Wollongong, and near Maitland. The samples obtained from these seams differ considerably from each other in appearance, in fracture, and in yield, but they have been proved to be available. The seam discovered in the Hartley district is situated in the vale of Clwyd, about four miles from Little Hartley. The seam was discovered in consequence of some pieces of the mineral out-cropping in the alluvium; it is five and a half feet in thickness, and is worked through a tunnel. Experiments have been made which show, it is alleged, that this mineral resembles that worked in Scotland, and known as Bog-head coal. It was also stated that the Hartley mineral was superior to that of Bog-head, in consequence of its yielding a larger quantity of oil, and also of its freeness from sulphur. Two feet of the gas made from this mineral gave, it was said, a greater illuminating power than five feet of gas obtained from ordinary coal. It was estimated that a ton of the mineral would yield about 140 gallons of crude oil. The annual import of kerosene oil into this colony is set down at 200,000 gallons, and that into the whole of the Australian colonies at about a million gallons; and it was confidently believed that the oil could be produced there at a lower price than it could be imported from America, and that therefore an extensive and valuable source of productive wealth would be opened up.

English Game in Victoria.—The acclimatisation in Victoria, of the English hare and pheasant, appears to be successful. At a recent meeting of the Council of the Acclimatisation Society there, a most encouraging statement was given as to the results of the breeding season. About 200 pheasants had been reared, and in one paddock 13 hares had been counted.

Manufactures of New Zealand.—Amongst other recent additions to the works and manufactures of this colony are bleaching and dye works. A carriage factory has recently been established, and although to some the project at first appeared somewhat chimerical, a steady and rapidly-increasing business has sprung up. The premises are unpretentious enough, but it is stated some of the gay equipages which are now constantly seen in the streets of Auckland have either been built at this establishment, or have received finishing touches in their construction and repairs. The proprietors, having recently secured skilled labour from the Australian colonies, have been turning out some very superior vehicles. Very considerable progress has been made in the erection of the gas works at Brickfield Bay, and an announcement had been made by the directors that they would be prepared shortly to light Auckland with gas. The mains through the city have almost all been laid, and connecting pipes are being introduced in most of the principal business premises in the principal streets of the City.

Italian Labour in Queensland.—A company has been formed for the importation to this colony of a stream of Italian artizans skilled in the production, cultivation, and management of various products suitable to the climate of Queensland, such as olives, citrons, spices, vines, oranges, and mulberry trees, and dried fruits, such as figs, raisins, currants, &c., as the climate of this colony and that of the south of Italy are generally said to be similar. The projectors state that the Colonial Ministry intend to propose to parliament that a lease over 20,000 acres, in the vicinity of Brisbane, be granted to the company, at a nominal rental, and for a term of ten years, and at the expiration of this period that a free grant be given to the company of all the land that will then have been improved.

Obituary.

Sir William Jackson Hooker, K.H., F.R.S., F.L.S., D.C.L., director of the Royal Botanic Gardens at Kew, died on the 12th inst. He was born at Norwich, in 1785, and from an early youth devoted himself to botanical studies, eventually becoming Regius Professor of Botany in the University of Glasgow. That appointment, however, he gave up for the directorship of the Royal Botanic Gardens at Kew. On the recommendation of Viscount Melbourne, then Prime Minister, he received the honour of knighthood in 1835, and in 1845 received the degree of D.C.L. from the University of Oxford, on the nomination of the Duke of Wellington, the Chancellor. Sir William was the author of "The British Flora," "Flora Borealis Americana," "Icones Filicum," "Genera Filicum," "Musica Exotici," "Flora Exotica," "Musculogia Brittanica," &c., and contributed the botanical portion of the work to Admiral Beechey's account of his

voyage of discovery in the Arctic region. He was a member of most of the learned and scientific societies, both upon the Continent and in America, and Knight of the Legion of Honour.

Publications Issued.

LE MOUTON. Paris. 8vo.—The natural history of the sheep, its breeding and management, value, and disease, by M. Lefour, Inspector-General of Agriculture in France.

LES CHEMINS DE FER AUJOURD'HUI ET DANS CENT ANS, ETC., by M. Audiganne, Paris.—A treatise on railroads in the financial, industrial, political, and moral point of view, by the author of a remarkable book on the working populations and industry of France.

LA DANSE DES NOCES. Folio; Paris.—A reproduction, in twenty plates, of one of the most curious series of wood engravings of the earlier half of the sixteenth century, the work of Hans Scheufelein, the date of whose birth is supposed to be 1490; he was a pupil of Albert Durer, with whom he worked till 1512, when he went to Augsbourg to illustrate the celebrated *Thewrdannck*, produced at the expense of Maximilian I. In 1515 he was made a burgess of Nordlingen, for his picture of the "Battle of Béthulic," now in the Hôtel de Ville of that city, and his works are well known in Germany; there are three in the Museum of Berlin, and six in the Pinakotheque at Munich. The "Danse des Noces" is in fact a marriage procession; one plate represents a platform or tribune with musicians, a fool, and other figures; another, three torch-bearers preceding the bride, who is escorted by two cavaliers; and each of the others, a lady or gentleman marching or dancing. The style is extremely bold, the figures about ten inches in height, and the costumes and details give the work an interest apart from that of its antiquity and intrinsic value as a work of art. The last of the original editions was published in 1560, and the first probably thirty years previously. The work has been reproduced with great care by Johannes Schratt, from a copy of the first edition in the possession of the Master of Ordnance of Hauslab, at Vienna. A biographical notice, by Dr. Andresen, precedes the plates.

Forthcoming Publications.

HISTOIRE DE LEONARDO DA VINCI.—M. Arsène Houssaye, the well-known writer and editor of the *Artiste* of Paris, is engaged on a life of the celebrated painter, whose remains were discovered by M. Houssaye at Amboise. It is promised in the winter of the present year.

Notes.

BERNARD PALISSY'S FURNACE.—A most interesting discovery has been made beneath that portion of the gallery of the Louvre which joined the Tuileries on the river side, and which is now being re-built. The workmen came upon a large potter's furnace, or oven, which was opened under the direction of M. Adolphe Berty, architect, and found to contain a certain number of moulds for the production of statues. A letter is in existence in which Bernard Palissy proposed to Catherine de Medicis to construct, in the garden which then adjoined the Tuileries, a monumental grotto, decorated with extraordinary figures, of which the writer gives a minute description. The moulds are said to agree precisely with those descriptions, and it is therefore conjectured that Palissy set up his kiln in the immediate neighbourhood of the grot to be executed. There was found also amongst other relics, the mould of the bust of a soldier, supposed to have been one of the Queen's Swiss guard, a man of peculiar build. Further researches are being made.

ADOPTION OF ELECTRIC COMMUNICATION BETWEEN PASSENGERS AND GUARDS ON THE SOUTH-WESTERN RAILWAY.—The managing authorities of the London and South-Western Railway have just adopted the system of electric communication between passengers and guards of trains which was brought lately under the notice of the public by Mr. Preece, the telegraphic superintendent of their line. The carriages of the Exeter express are now fitted with the apparatus, and plain directions for its use have been issued. These are as follows:—"In the event of something of a serious nature occurring which urgently requires the stoppage of the train, the passenger may 'break the glass' and 'ring,' by moving the bell handle in the direction denoted by the arrow. Thereby a bell will ring in each guard's van, and also on the engine. When the guards and enginemen hear the bell ring, they will at once look carefully along each side of the train, and in case any violent oscillation be seen, or a carriage be on fire, or other occurrence of a serious character be observed, the train will be stopped as speedily as possible, and when stopped must be protected by signals as prescribed. Should, however, the guard and engine-driver fail to observe anything which really necessitates an immediate stoppage of the train, their duty will be to stop the train at the next station or junction, so as to protect the train when stopped by the fixed signals. When the train is stopped, the passenger who broke the glass and rang the bell will communicate with the guard; but should he fail to do so, the guard will detect the compartment from which the passenger gave the alarm by looking for the broken glass; and, in case the alarm has been mischievously and wantonly given, or from some insufficient cause, the names and addresses of all the passengers in that compartment will be taken, in order that the law may be enforced." The instructions conclude with an earnest request that the passengers will protect the communication from improper and mischievous use, as it is very important that it should not be used without real and urgent necessity.

VENTILATION.—General Morin has lately read a paper before the French Academy, on the means for supplying fresh air to meeting rooms, places of entertainment, theatres, railway stations, &c. During the summer he has made experiments in connection with the passage of air over water in a minute state of division; through coils of tube surrounded with water; on the action of metallic surfaces; the watering the roofs; and with openings more or less in number arranged both above and below the galleries, &c. But these different means have turned out of little value; continued watering of the roof alone lowered the temperature within the fraction of a degree below that without. M. Regnault remarked that the plan adopted by General Morin does not solve the question, the solution of which he considered to be based, 1st, on the employment for roofing and for the walls, of a double envelope, between which air will circulate brought in through air-drains formed in the soil, and distributed by means of holes made in a number of pedestals a little higher than the heads of the company. The hot external air and the rays of the sun striking on the outer envelope would produce, in a very simple manner, a draft, causing the air to circulate rapidly between the two envelopes. This system had been applied to the building for the Fine Arts department of the Universal Exhibition of 1855, and found to answer perfectly. General Morin agreed with M. Regnault as to the excellence of the double envelope, but he did not put faith in the supply of air through the air-drains in the soil. He thought it of the utmost importance that his system should be applied to railway stations, where the temperature frequently rose to 45° or 48°.

AGE AND VORACITY OF THE PIKE.—A pike, between four and five feet long, and which is believed to be a cen-

tury old, was taken recently at St. Paul en Cornillon, on the Loire. In its stomach were found a double-bladed knife, a small key, and the steel snap of a purse. The fish is being prepared for the museum of Saint Etienne.

Flight of Pigeons.—The *Société Colombiphile* of Brussels sent twenty cages, containing 680 carrier pigeons, to the Mairie of Bordeaux the other day, requesting that the birds might be let loose on the following morning, at five o'clock precisely. This was done, and the pigeons rose at once to a considerable height in the air, arranging themselves in groups, and, after a few seconds of apparent hesitation, started off towards the north; about a dozen only rested for a few minutes on the Cathedral and Hôtel de Ville, and then made of in the same direction. The distance from Bordeaux to Brussels is about six hundred and sixty miles, and the pigeons reached home at half-past three o'clock in the afternoon of the same day, so that the journey was performed at the rate of sixty-three miles an hour.

Patents.

From Commissioners of Patents Journal, August 11th.

Grants of Provisional Protection.

Air, mechanism for flying through the—1037—G. W. Rothleb.
Aerated liquids, receptacle for—1923—M. B. Schumann.
Ammonia, carbonate of—1933—A. P. Price.
Atmospheric changes, instrument for indicating—1891—H. A. Clum.
Bedsteads, sofas, and chairs—1912—G. Wilson and J. Goodfellow.
Bilge water, &c., ejectors for discharging—1981—A. V. Newton.
Boilers, locomotive and other tubular—1990—L. E. C. Martin.
Bolt screwing machines—1949—W. E. Newton.
Boots, shoes, &c., lacing of—1931—J. H. Johnson.
Breech-loading guns—1888—C. Rosson.
Breech-loading guns, fire-arms and cartridges for—1889—W. Tranter.
Buttons, studs, and solitaires, shank for—1930—H. Wright.
Cable shackle, chain or iron—1036—R. Turner.
Cap frames—1966—R. Worsnop.
Capillary attraction, motive power by—1874—J. E. F. Ludeke.
Casks and barrels, air-proof solutions for—1957—W. E. Newton.
Cotton, covers for rollers used in spinning—1901—G. Taylor and J. Crossley.
Crinolines—1974—A. Y. Rehm.
Docks, floating—1692—G. Turton.
Drawing instrument—1854—G. Clark.
Dress shirts and dresses, manufacture of—1188—E. Moore.
Electricity from magnets and induction coils, currents of—1979—A. V. Newton.
Electric telegraph instruments and relays—1654—I. Baggs.
Fabrics for hot pressing, folding—1909—W. S. Yates and A. Freeman.
Fire, giving alarm of—1998—J. Crean and C. J. Barr.
Flax, &c., preparing machinery for—1977—J. Lawson & E. G. Fitton.
Friction pulleys, &c.—1927—M. J. Roberts.
Gold, testing alloys of—1994—H. Levy.
Gunpowder, compositions similar to—1939—E. Spicer.
Hydraulic motive power machinery—1642—V. Baker.
India-rubber, &c., forming—1993—A. Ford.
Leather, rolling—2007—J. H. Tyler.
Linen, &c., manufacture of—1985—T. B. Paton.
Lock, fastening or—2003—R. Bailey and J. Eagland.
Locks and latch bolts—1902—J. Walton.
Locomotive boiler furnaces—1929—J. Juckes and J. Swinburne.
Metals, machinery for planing—1942—W. E. Newton.
Meters, fluid—1940—S. Lusty.
Motive power by heated air or aeriform fluid—1915—M. P. W. Roulton.
Motive power by heat, obtaining—1992—M. P. W. Boulton.
Motive power, obtaining—1910—E. Perré.
Omnibuses—1951—A. Cheffins.
Organs and harmoniums—1895—R. Smyth and W. E. Evans.
Ornamental fabrics, weaving—1960—W. Cockburn.
Outfitts, military and other—1926—T. J. Mayall.
Paddle wheels—1288—C. S. Baker.
Paper collars, machinery for making—1537—J. A. Woodbury.
Paper hangings, cutting the edges of—1965—A. A. Larmuth.
Peat in bogs, treating—2004—C. Hodgson.
Petroleum and other hydro-carbon oils, refining—1980—A. V. Newton.
Printers' rollers, composition for—1894—F. G. David.
Propelling, driving, and forcing purposes, mechanism for—1892—T. Swinburne.
Pulp, reducing vegetable fibre to—2002—W. W. Burdon.
Rails and girders, iron—1976—E. Sabel.
Railway and other carriages, break for—1959—R. B. Mitchell.
Railway carriages—1924—J. Rigg.
Railway carriages, breaks, and signals—2005—W. H. Petitjean and E. McNally.
Railway carriages, stopping or retarding—1969—J. Swinburne and J. Laming.
Railways and railway trains, signal and alarm apparatus—1880—J. G. Rowe.
Railways, apparatus for preventing accidents on—1945—J. Jacques, S. Wenk, and A. A. Mathieu.
Railways, crossings for permanent way of, and also tyres for wheels 1398—J. Armstrong.
Railway tickets, marking or impressing—1948—R. Mortimer.
Railway train, communication between the passengers, guard, and driver of a—1999—F. C. Dear.
Railway trains, communication between passengers and guards in—1997—J. G. Teal.
Railway trains, communication between passengers and guards of—1640—E. Byerley.
Railway trains, signals between passengers, guards, and drivers of—1955—I. Gregory.
Rudders—1919—J. McG. Croft.
Safes—1911—W. Diaper.
Safes, burglar proof—2006—H. Allman.
Safes, &c., fastenings for—1995—T. Andrew and J. W. Taylor.
Sal-ammoniac—1936—W. and J. Richards.
Sewing machinery—1941—A. V. Newton.
Sewing machinery and stitch formed by same—1641—G. Haseltine.
Sewing machines—1903—R. M. Wanzer.
Ships' bottoms, composition for coating—1943—F. Pulman and R. Ginman.
Ships' logs—1830—F. Massey.
Ships, composition for coating the bottoms of—1986—W. La Penotière.
Ships, propulsion of—1899—St. J. V. Day.
Soda and carbonate of—1914—J. P. Gillard.
Steam and other engines, valves for—1913—W. E. Newton.
Steam engines, condensing apparatus for—1897—M. L. Parry.
Steam, generating—1938—G. T. Bousfield.
Stoves and ranges, cooking—1944—W. Barton.
Swimming, apparatus for—1982—W. Clark.
Tables and table stands, ornamental—1925—L. Petré & E. S. Tucker.
Throat, instrument for examining the—1921—R. A. Brooman.
Velvets, plushes, and other pile fabrics—1937—J. Belicard.
Ventilators—1866—J. P. B. le Patourel.
Vessels, propelling—1890—C. H. Simpson.
Water meter—1958—W. E. Newton.
Waterproofing and insulating purposes, compounds for—1962—F. A. Abel.
Water-power, applying and utilising—1967—V. Baker.
Weaving, looms for—1524—T. Forster and J. Eckersley.
Weaving, looms for—1961—R. Clayton, J. Raper, and J. Goulding.
Windows, apparatus for cleaning—1907—C. Gardner.
Wood incombustible, process for rendering—1900—L. A. M. Chaulin.
Yarns, sizing or dressing—1906—E. Schaub.

Patents Sealed.

418. A. Fryer.	441. W. Kirrage.
423. R. P. Barrett.	462. P. E. Bidaux.
429. W. C. Ridings.	489. J. Keighley & R. Shephard.
431. W. H. Brown.	654. W. Clay.
432. M. Lane.	1028. R. A. Brooman.
433. C. Lungley.	1146. J. F. C. Carle.
437. R. H. Emerson.	

From Commissioners of Patents Journal, August 15th.

Patents Sealed.

442. R. A. Brooman.	583. S. Brooks.
444. H. J. Pickard.	594. W. Clark.
448. J. F. Hearsey.	598. J. S. Lillie.
452. R. Hill & R. Tushingham.	603. H. A. Bonneville.
465. C. Brakell, W. Hoehl, and W. Gunther.	604. H. A. Bonneville.
470. W. Robinson.	606. J. H. Johnson.
472. L. W. G. Rowe and A. Baab.	607. J. H. Johnson.
477. W. E. Gedge.	618. E. Pettit.
478. J. Cliff.	743. A. V. Newton.
479. J. D. Nicol.	1319. H. Ransford.
497. T. G. Webb.	1418. H. Nunn.
517. W. E. Gedge.	1568. G. Haseltine.
561. W. Clark.	1572. G. Haseltine.
	1678. G. Haseltine.

Patents on which the Stamp Duty of £50 has been Paid.

2221. F. M. Jennings.	2280. A. Walker.
2226. E. Humphrys.	2380. W. E. Newton.
2244. J. Lancelot.	2877. W. Clark.
2413. J. Nickson and T. Waddingham.	2257. A. Delrue.
2509. T. Molineux.	2258. C. M. Westmacott.
2247. J. Combe & J. H. Smalpage.	2285. W. Beatson.

Patents on which the Stamp Duty of £100 has been paid.

1868. L. A. Herrmann and E. I. E. Herrmann.	1839. A. J. Paterson.
	1851. T. Worth and H. Spencer.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, AUGUST 25, 1865. [No. 666. Vol. XIII.

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Announcements by the Council.

PROGRAMME OF EXAMINATIONS FOR 1866.

In the List of the Secretaries of Local Boards, published in last *Journal*, the following was omitted:—

Christchurch.................. Mr. Wm. Judd, F.C.S.

Proceedings of the Society.

MUSICAL EDUCATION COMMITTEE.

The Committee met on June 12, 1865. Present:—H. Cole, Esq., C.B., in the chair; Lord Gerald FitzGerald, Sir John Harington, Bart., Colonel Scott, R.E., Captain Donnelly, R.E., Messrs. R. K. Bowley and R. Puttick.

The Right Hon. SIR GEORGE CLERK, Bart., examined as follows:—

246. I observe by the Charter of the Royal Academy of Music, there is a Board of Directors and a Committee of Management, but practically, I suppose, they are nearly the same body?—The Committee of Management are a Committee of the directors.

247. Has that always been the case?—They are practically one and the same. There are not so many directors as are authorised by the Charter.

248. The Charter would seem to have intended that there should be a Board of Directors and a Committee of Management besides; but practically they are the same body?—No: the Directors are all members of the Committee: and when there is any important business to transact they are specially summoned to meet.

249. The members of the committee of management are not necessarily directors?—I think they have always been.

250. It seems to be mere matter of form; the two bodies are practically the same?—Yes.

251. Whatever the intention of the charter was, practically it is the same thing?—Yes.

252. They take no part in the professional instruction?—They do not interfere in the details of the musical instruction. Their duty is to attend chiefly to the finances, and to take care that no irregularities are committed; and if there is anything either from neglect on the part of the professors or the students, that is reported by the principal to the committee, who take such measures thereupon as they judge expedient.

253. Do the subscribers have a voice in the election of directors?—I believe they have; but the subscribers are a very small body.

254. In fact the charter is all but a dead letter?—No; but the directors being a self-elected body fill up the vacancies themselves.

255. Do you consider the public might be induced to take an increased interest in the institution, and furnish funds if they had an interest in the election of the directors and managers?—Perhaps they might, and we should be glad to see such an interest awakened as would give it a greater degree of popularity. At first, when students were educated at a very low fee, it was a matter of favour to admit them, and they were admitted by the votes of the subscribers; but very soon after the establishment of the Academy it was found that the funds were perfectly inadequate to carry it out on the scale first proposed. We were obliged then greatly to increase the fees paid by the friends of the pupils, and it ceased to be a matter of great importance to the subscribers to have a vote. The pupils now are obliged to be recommended by a subscriber, or some person connected with the Academy. At present we are obliged to ask so large a sum that there is very little difficulty with regard to the admission of students, if they exhibit any talent at all, and that evidence makes it scarcely a favour to be admitted into the Academy; and this does to a certain extent weaken the discipline of the officers of the Academy.

256. Did Parliament accompany the late grant to the Academy with any stipulations or conditions?—There were some conditions stated in the Treasury letter, which go to the effect that we should be able to show, with the additional subscriptions we get, the Government grant would be sufficient: that it was not merely giving a grant for two or three years to an institution which was likely to become insolvent in that period.

257. Is the competition for the scholarships public?—It is conducted by the various professors of the Academy, and subscribers are entitled to be present while the competition is going on.

258. Have you any objection to put in a copy of the Treasury letter?—Not the least. (See Appendix, p. 635.)

259. Do the members of the Committee of Management inspect the working of the Academy, or is it left to the principal?—They do not interfere, as I have said, in the details of professional instruction. We leave to

the principal the general superintendence of the Academy. He is the intermediate authority between the Committee and the professors, and he is there the greater part of the day.

260. He is that intermediate authority—not the secretary?—The secretary never had anything to do with that.

261. Who notes down the attendances of the professors?—There is a book kept in the hall, and every professor is required to enter his name as he arrives, and the porter puts in the hour and minute at which he arrives; and on leaving the Academy the professors enter their names in another book to show when they leave, so that there is a complete check upon the time they attend.

262. Referring to the Charter, I find that the number of members may be indefinite?—That means the subscribers; that is, the body corporate may be indefinite.

263. The board of directors is to consist of thirty members?—Yes.

264. Besides these thirty directors there is to be a committee of management of not more than fifteen, nor less than seven? It does not appear from the charter that they necessarily are the same persons?—No.

265. But practically at the present time they are?—We can get no others.

266. Do the Directors or the committee of management appoint the professors?—The directors have attended as a matter of form for many years; they attend one or two meetings a year.

267. Are the Professors paid wholly by fees?—They are paid at so much per hour of attendance.

268. Not acccording to the number of students?—It is so to a certain extent; because, as they give half an hour's separate instruction to each pupil, a professor who has twice as many as another must attend double the time and receives double the amount of remuneration. They are paid according to the number of students they have under them, because that makes the time.

269. Then a professor has a pecuniary interest in the number of pupils he teaches?—Certainly.

270. Have you any students whose fees are wholly remitted?—I think none at this moment.

271. But you have students who pay different grades of fees?—As a matter of favour some indulgence has been given.

272. You have some who hold scholarships?—We have four scholarships; two King's scholarships which nearly pay the whole expenses of the education. The others pay only about one-third part of it.

273. Should you consider it desirable to increase these scholarships?—Yes: I think it would be a means of inducing promising pupils to remain till their education was completed, which is frequently not the case now from want of means on the part of their friends to keep them at the Academy.

274. Do you think it likely increased subscriptions would be obtained by increasing the number of scholarships?—I think it would be a likely means of doing so.

275. You would have no objection to the funds being increased by some process of that sort?—That would educate at a reduced rate a certain number of pupils, but it would not afford funds for carrying on the general business of the Academy.

276. If the institution was made thoroughly efficient, and very attractive, it is not difficult to conceive that some classes of students, sufficiently rich, would pay fees enough to cover the cost of management, and you might look forward to obtaining from the State a sufficient endowment to establish several scholarships?—The friends of pupils who join the Academy with the intention of devoting themselves to the musical profession can only pay fees which cover the expense of the education. The object of the Academy is to afford the means of more thorough musical education to persons who devote themselves to it professionally. It is not our wish that amateurs should be educated in the Academy at a reduced rate.

277. You would have no objection to amateurs joining the Academy if they paid sufficiently remunerative fees?—I think it might be managed, but I doubt whether it would be expedient.

278. Does the Academy require that they shall be professionals?—It is understood that is their intention either to become public professors or teachers.

279. You have had long experience in Parliamentary life and proceedings. Have you any expectations that Parliament could be induced within any reasonable time to give a grant of £10,000 a year to the Academy?—I cannot say that I have.

280. Perhaps if a more modest request were made, and put upon sufficient grounds, it might be more successful?—I doubt very much at the present time whether any Chancellor of the Exchequer would venture to propose any great increase upon the present grant.

281. Any materially increased assistance from Government must come from an expression of public opinion in favour of it?—Yes; perhaps so.

282. What, in your opinion, would be the result of a Parliamentary committee of inquiry?—A committee of the House of Commons on the subject of music I think would do no good. If any inquiry is made it would be better to have a Royal Commission.

283. You are entirely on the side of the improvement of the present Acadamy if it can be effected?—We have stated publicly, and distributed circulars to the effect, that our object is to have the fullest inquiry into the management, and our desire to adopt any alterations and improvements that may place the Academy upon a more popular basis.

284. If you had premises suitable in all respects rent free it would aid you materially?—Yes.

285. I believe the authorities of the Academy applied to the Royal Commissioners for the Exhibition of 1851 for their aid in providing a new site for premises at Kensington?—I was deputed by the committee to communicate with the Prince Consort on that subject, and his royal highness, I believe, was quite willing to have assigned a portion of ground at Kensington for the purpose; but it was merely as to the site. I explained to his royal highness that it was quite out of our power to erect a building upon it.

286. If, in addition to a site, a building suitable for your purposes were put up on it, you would receive it with great satisfaction?—Yes; I should indeed.

287. Then it is not correct, as has been stated, that you have declined the assistance of the Commissioners of the Exhibition of 1851?—No; we do not refuse the smallest donations.

288. We understand that the principal of the Academy has the entire responsibility of the musical education? How long has that existed? Was there not at one time a board of professors?—A board was appointed as assessors, to assist the principal in any cases he required.

289. The principal has been the only responsible person?—Yes.

290. And he has been the person to appoint the teachers?—He has not had the selection of the teachers alone. He recommends to the committee of management that such and such persons should be appointed, and he gives a recommendation as to the distribution of the pupils to the various professors.

291. Do you think it for the advantage of the Academy that there should be one superintendent only, or that the responsibility should be divided?—I think it better to have one sole and undivided authority.

292. If you appoint a musical professor to the office of principal, he is practically chosen for life, and there would be some difficulty in removing him from it?—It might be difficult.

293. I would ask you whether you do not think that

a disadvantage?—It depends upon a judicious selection being made in the first instance.

294. Is the present principal paid by a salary?—Yes: that is a recent arrangement. We thought it would add to the dignity of the office to pay him a fixed salary, the amount of which is as near as possible what he received as a teacher of harmony in the Academy.

295. Is it not usually found to be the case in educational institutions that they generally succeed better if the masters and teachers are paid according to the success of the institution; at our great schools the success or otherwise is judged of by the amount of income of the principal?—That arises from the number of students and a capitation allowance.

296. Do you think that principle might be introduced with advantage into the Royal Academy of Music?—Only to a limited extent, perhaps; because I do not think it desirable to increase the number of musical teachers in the country beyond a certain limit, as there might be no opportunity for their being absorbed as performers or as instructors.

297. Would you not have the institution grow to any extent possible, within the capabilities of management?—You might go so far as to make the supply of teachers far beyond the demand. We have not come to the limit yet, certainly.

298. Is it your opinion that, in addition to a liberal salary, the principal should be remunerated according to the success of the institution?—I think that would be a very valuable principle; and, perhaps, the best mode of judging of results, that there should be something in the nature of a capitation allowance for each scholar. It might be of service in stimulating the exertions, not only of the principal, but of the other professors altogether.

299. Is it not desirable that you should make periodical reports to Parliament upon the working of the institution, seeing you are now receiving Parliamentary funds?—We may be called upon to do so. I may mention generally we have found great difficulty for years in carrying on the institution in what I consider a perfectly satisfactory manner, from the deficiency of funds. In some respects we have been obliged to reduce our establishment to the lowest point compatible with efficiency, and I am afraid we have to some degree gone beyond that, particularly in dispensing with the services of a general superintendent—not a professional musician—whom we had at one time, and to whom we paid a moderate salary.

300. Now you have only a principal?—That is all.

301. At that time the principal was not salaried?—No.

302. It appears by the paper which has been furnished by Mr. Gimson, of the receipts and expenditure of the Academy, that the cost of each pupil, including maintenance of the establishment, is on an average £45 a year?—That would vary according to the number of students there happened to be in any particular year. If there were a great number of students a small surplus over what is paid for the musical education would be sufficient to maintain the establishment; but some years there are a small number of pupils, and then the expenses divided amongst that small number would be high.

303. Do you consider the amount of musical education given in the Academy in each branch sufficient to complete the pupils?—I should say so if they remained at least three years.

304. Practically do you find that the pupils derive their education during the term they are at the Academy, solely from the Academy, or do you find in some instances they have private tuition besides?—I am not aware of any such cases. Their time is so fully occupied with lessons and practice, and the expenses of the Academy are so much complained of, that I doubt whether any of the pupils go beyond that.

305. Can you give the committee any idea of the average expense for each pupil in an Academy of Music conducted as you would wish it to be, and with a sufficient amount of education?—I say from £40 to £45 a year would be amply sufficient; and if the funds of the Academy amounted to a sufficient sum, we would like a reduced contribution from the pupils.

306. With regard to the amount of fees paid by the pupils, do you consider it to be generally too high?—I am afraid it is too often felt to be so by the parents. We have had cases in which the friends of pupils of great talents have said unless the fees were reduced they would be obliged to withdraw the students.

307. Do you think that might be met by having graduated payments? Or do you think it impolitic to admit students at too low a fee, and that the cheaper you make musical education the more common you make it, and that the tendency would be to lower that class of education?—I think it could hardly be the case with a musical academy. It would make it important to get admission, and there would be a stricter examination. At present no person with talent is refused, at a moderate rate of payment—two-thirds or one-half the usual amount is sometimes taken to induce them to remain till their education is completed.

308. You would be in favour of taking smaller fees in cases of great competency and promise?—Yes; we have done so. In many instances we have agreed to take a smaller amount than the regular fee from pupils who have shown great talent.

309. The amount of annual subscriptions to the Academy do not much exceed £200?—No, they do not.

310. To what do you attribute that small amount of public subscriptions? Is it to want of popularity of the institution?—People do not subscribe money generally, unless they get a *quid pro quo*. What have we to offer? If there were the inducement of attractive concerts it might be different. As it is we have no public inducements to hold out.

311. Could you not hold out the inducement of repeated concerts?—We hold concerts of the pupils, and we find the expenses exceed the receipts.

312. Do you think some system might be devised by which benevolent people of musical tastes, and wealthy, would be disposed to pay at once the necessary fees for the education of a student, and having the right of maintaining a student?—We have had instances of persons undertaking to pay the fees of a student for two or three years.

313. As you are aware there are numerous charitable and educational institutions in which the donation of a certain sum, £100 or £500, as the case may be, entitles the donor to a nomination to the institution; do you not think that plan might be applicable to the Academy of Music?—I think there is hardly sufficient public interest in music to hope much from that source. The Academy would be only too happy if it were so. We should be ready to modify the system in any way that might be thought desirable.

314. Is there any person in the existing governing body of the Academy to make new rules for the regulation of the Academy?—The directors and committee may make bye-laws, not inconsistent with the general provisions of the charter.

315. Would it be in the power of the directors to make a bye-law that persons making a certain donation to the Academy should be entitled to the nomination of pupils?—There could be no difficulty about it, nor do I imagine there could be any objection to it whatever.

The Committee then adjourned.

APPENDIX.

Copy of a Letter from the Lords Commissioners of Her Majesty's Treasury.

Treasury Chambers, June, 29, 1863.

My Lord,—I am directed by the Lords Commissioners

of Her Majesty's Treasury to acknowledge the receipt of the memorial addressed to the Chancellor of the Exchequer by the directors of the Royal Academy of Music for the grant of assistance from Her Majesty's Government.

Their lordships have also had before them a paper, signed by the Principal of the Royal Academy of Music, forwarded on the 29th of April last, submitting observations and suggestions on behalf of the professors of the Royal Academy of Music, and a memorial of the professors, members, associates, and honorary members of that Institution.

My lords are disposed to agree that it may justly deserve consideration, whether on general grounds it might not be proper to afford some public aid or recognition to the art of music. They are also of opinion that the remarkable extension of taste and knowledge with respect to this art, which has taken place within a recent period, does not of itself dispense with the necessity of special efforts, and of special institutions with a view to the scientific training of well-selected pupils in the principles and practice of the art. It has been found in the case of the general education of the people, that there is much more disposition to support the teacher when trained than to assist in keeping at work the machinery which is necessary for training him. The same thing may be true with such qualifications as the difference of subject suggests in the case of the artist in music.

My lords are therefore disposed to take into consideration, before the estimates of next year are proposed, the question whether some aid or recognition by the state might not fitly be extended to the art of music, and to some institution connected with it.

Undoubtedly the institution which first offers itself to view as presumptively entitled to the benefit of such consideration of the general question, is the Royal Academy of Music, from the high character of the countenance it has enjoyed, from the services it has rendered during a series of years, and from the testimony which has been borne to its merits in the memorial from the Professors of Music to which reference has been made.

It is, however, one thing to aid by money or building an institution already self-supporting and efficient, with a view to its greater and more lasting utility, and another thing to undertake to supply similar support to an institution whose resources appear to be diminishing and wasting away, so that the state might soon, and yet unawares, become virtually pledged to engage to supply both its maintenance and its management.

My lords regret to perceive the extreme slenderness of the present funds of the Royal Academy of Music.

Upon the whole they think it their duty to attach to the statement they have made above in favour of the consideration of the question, the following reservations:—

1. In the event of their taking any step such as has been shadowed out, they remain free entirely to consider what shall be the nature, particulars, and conditions of any aid which it may be proposed to give.

2. In particular, they will deem it necessary to be assured, by sufficient proof, that the institution which may claim to be the immediate recipient of aid is not only one entitled to acknowledgments for past services, but is also in possession of the general confidence of the profession, and is constituted in the most effective manner, and on the most liberal principles for the prosecution of its purposes; or else is engaged in adopting such measures as may entitle it to claim to correspond with this description.

3. They would think it necessary that measures should be adopted by the Royal Academy of Music to obtain a much more extended amount of voluntary support, so as to secure to it the character of an institution having the promise of permanence from its own resources, and seeking not to throw upon the state a task refused by private liberality, but to obtain by the countenance, as well as the funds of the state, power to prosecute its proper aims, upon a scale more fully adequate to their importance.

My lords are quite willing that the Directors of the Royal Academy of music should make such use of this communication as they may think proper.

I am, My Lord,
Your obedient servant,
(Signed) G. Arbuthnot.

The Earl of Wilton,
Chairman of the Directors of the
Royal Academy of Music.

Proceedings of Institutions.

Chatham, Rochester, &c., Mechanics' Institute.—The twenty-eighth annual report says that during the year there has been no increase of subscriptions, but rather the reverse. The previous report showed that more than £100 remained over and above the necessary expenditure at the close of last year. £46 has been expended for the purchase of books, which enabled the committee to place about five hundred fresh volumes in the library. An addenda to the old catalogue was also prepared, at a very considerable expense, which has found but few purchasers, so that its publication has entailed a heavy loss upon the Institution. The statement of the librarian that 6,240 volumes have been issued during the past year, shows that the readers must be numerous. The committee are endeavouring to increase the inducements for artizans to join the Institution, and to that end have again made efforts for the formation of classes, and, that no one may be excluded from participating in their benefits by want of means, it has been determined to issue a ticket of membership, the price of which shall be 1s. 6d. per quarter throughout the year; and that to join a class, it will only be necessary to pay sixpence per quarter additional. A mechanical drawing class is now in operation, under Mr. T. Merritt, and a Latin class will, it is hoped, be formed immediately, under the Rev. S. Arnott, Vicar of Chatham. Other gentlemen have also kindly offered their gratuitous services, so that the committee can undertake to find a teacher for almost any branch of study which six of the members may express a desire to enter on. The committee point out the benefits which may be derived by entering the classes, and speak of the advantages of examinations. One of the candidates, a member of this Institution, who took a first-class certificate, and the second prize in arithmetic of three guineas, as well as a second-class certificate in algebra, had the pleasure not only of receiving these rewards from the hand of the Prince of Wales, and of having his certificate signed by Mr. Charles Dickens, as president of the local board of examiners, but of almost directly being appointed to a clerkship on the Cobham estate, by the Earl of Darnley, who considered these documents quite satisfactory evidences of his fitness for the office, which will doubtless prove a first step to his advancement in life. The committee, while mentioning that the Institution has been affiliated to the Kent Association, express their admiration for the public spirit and energy displayed by the chief promoter of this union—Mr. W. Monk, of Faversham, through whose indefatigable exertions the people of that town have obtained an institute which may be well taken as a model for the formation of others of a similar character. The greatest effort made by the committee during the past year was that for getting up a local exhibition of things curious, beautiful, and interesting, in the lecture hall; this was a complete success as an exhibition, although, in a pecuniary sense, to some extent a failure, the expenditure having exceeded the receipts by about £10.

SLOUGH MECHANICS' LITERARY AND SCIENTIFIC INSTITUTION.—The last report congratulates the members on the continued prosperity of this Society. The total amount of receipts for the year was £142 3s. 7d., while the payments for the same period were £125 0s. 3d., leaving a balance of £17 3s. 4d. in favour of the Institution. The society comprises at the present time 147 members. The committee desire to record their thanks to the President, Lord Taunton, for the great interest he has manifested in the welfare of the Institution, and more especially for granting the use of Stoke-park to its members for the last 12 years, thereby affording most agreeable recreation and amusement, and at the same time materially aiding the funds of the society. The library contains upwards of 1,200 volumes, and 1,300 volumes were issued to the members in the past year. The committee hope that as opportunities arise, the friends and supporters of the institution will kindly favour them with donations of books. The committee report the continued success of the drawing class, conducted by Mr. Chapman, assisted by Mr. Dorrell. This last year there has been a greater number of pupils than formerly, and the attendance especially in the first half of the year very good; on some occasions more than 40 were present at the class meetings, the average attendance throughout the year being about 32. At the Art Examination at Kensington and at the Society of Arts Examination, the students acquitted themselves with great credit. At the Government Science Examination, three members won prizes; others were successful, but having carried off prizes in former years they could not again receive them. A master's certificate has been obtained by Joseph Watson at the November examination; this now makes six master's certificates in geometrical drawing, and two in building construction, held by the members of the drawing class of this institution. The prizes subscribed for by the friends of the class, known as our "Purchase prizes," are more numerous than usual, eleven having been awarded. The committee are highly gratified by these good results, and feel most thankful to Mr. Chapman, who has devoted himself for so many years to the gratuitous instruction of the drawing class. The arithmetic class is successfully continued, and the committee offer their best thanks to Mr. Duncan Shaw for giving his voluntary services in the conducting of it. The attendance upon the lectures was on the whole good. Public readings have been held, each one attended by a numerous and attentive audience.

EXAMINATION PAPERS, 1865.

(*Continued from page* 610.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

LOGIC AND MENTAL SCIENCE.

THREE HOURS ALLOWED.

LOGIC.

1. State in detail what is treated of under the heads simple apprehension, judgment, and reasoning respectively.

2. What are the predicables, and what the predicaments? Give illustrations of both.

3. What is meant by the comprehension and what by the extension of a term? How are the two related to each other? Give examples.

4. Give the rules of definition and division. When is a division false?

5. In how many ways may propositions be converted? Give the rules of conversion for each class of propositions designated by the letters A, E, I, O, respectively.

6. Explain what is meant by the major, minor, and middle terms of a syllogism, with illustrations.

7. Evolve the following sentences into syllogisms, pointing out in each case the major, minor, and conclusion:—(*a*). Many of the heathen philosophers recommended persecution, and therefore could not have been good men. (*b*). Because they are envious and ill-natured the censorious are generally detested. (*c*). Most of the learned in the fifteenth century believed in witchcraft, and must consequently have been very credulous persons.

8. How many figures are there? Give the special rules of each. In what mood and figure are the following syllogisms drawn? How are they symbolically designated?

All true penitents will find mercy.
Some true penitents have been great sinners.
Some who have been great sinners will find mercy.

Many philosophers have contradicted their principles by their practice.
All who do so are dishonest.
Some dishonest persons have been philosophers.

9. What is an enthymeme, an epicherema, and a sorites? Give an example of each.

PALEY'S MORAL PHILOSOPHY.

1. State any arguments you can advance for or against a moral sense in man.

2. What is meant by utilitarianism? In what sense is Paley a utilitarian, and how does he differ from others?

3. In what, according to Paley, may we say that human happiness does and does not consist?

4. What is the object, the rule, and the motive of virtue respectively as stated by Paley?

5. Give Paley's definition and division of rights.

6. Give some account of the rise of property. Show its use, and on what specific right it is founded.

MILL'S LOGIC OF INDUCTION.

1. Distinguish between induction strictly so called, and induction improperly so called.

2. Give Mill's view of the law of causation. Is his theory of causation universally held? What other theories have been propounded?

3. Explain the four methods of experimental inquiry according to Mills' analysis, and give the canon of each.

4. What is an hypothesis? What is its use in philosophical inquiry? What errors must be guarded against in its use?

5. Explain Mills' view of the nature and uses of analogy in philosophical researches.

STEWART'S PHILOSOPHY OF THE HUMAN MIND.

1. State any of the advantages arising from the study of the human mind, and the method by which it should be conducted.

2. Give a brief sketch of Reid's controversy on perception, and the conclusions to which he arrived.

3. Give a philosophical definition of abstraction, and then sketch the views of the nominalists and realists respectively.

4. What is meant by the association of ideas? Give a classification of the laws of association.

5. State what Stewart says on the different kinds of memory, and the means by which memory may be cultivated.

6. Distinguish between conception and imagination. Give illustrations of both.

BUTLER'S SERMONS.

1. What does Butler mean by human nature, and of what elements does he affirm it to consist?

2. Give his reasons for asserting the supremacy of conscience as a principle of human action.

3. In what sense may a person who follows his appetites *only*, be said to act contrary to nature?

4. Give a concise abstract of Butler's whole argument, to show that human nature, rightly interpreted, leads invariably to the practice of virtue.

LATIN AND ROMAN HISTORY.

THREE HOURS ALLOWED.

Section I.

Translate:—

At regina, nova pugnae conterrita sorte,
Flebat et ardentem generum moritura tenebat:
"Turne, per has ego te lacrimas, per si quis Amatae
Tangit honos animum—spes tu nunc una, senectae
Tu requies miserae, decus imperiumque Latini
Te penes, in te omnis domus inclinata recumbit-,
Unum oro: desiste manum committere Teucris.
Qui te cumque manent isto certamine casus,
Et me, Turne, manent: simul haec invisa relinquam
Lumina, nec generum Aenean captiva videbo."
Accepit vocem lacrimis Lavinia matris
Flagrantes perfusa genas, cui plurimus ignem
Subiecit rubor, et calefacta per ora cucurrit.
Indum sanguineo veluti violaverit ostro
Si quis ebur, aut mixta rubent ubi lilia multa
Alba rosa: tales virgo dabat ore colores.

1. Parse fully, giving both syntax and accidence, the words sorte, lumina, lacrimis, genas, cui, violaverit.
2. Give the present and perfect tenses indicative active and the supines of the verbs tangit, committere, manent, relinquam, videbo, dabat.

Section II.

Translate:—

Ac velut immissi diversis partibus ignes
Arentem in silvam et virgulta sonantia lauro,
Aut ubi decursu rapido de montibus altis
Dant sonitum spumosi amnes et in aequora currunt,
Quisque suum populatus iter: non segnius ambo
Aeneas Turnusque ruunt per proelia; nunc, nunc
Fluctuat ira intus, rumpuntur nescia vinci
Pectora; nunc totis in vulnera viribus itur.
Murranum hic, atavos et avorum antiqua sonantem
Nomina, per regesque actum genus omne Latinos,
Praecipitem scopulo atque ingentis turbine saxi
Excutit effunditque solo: hunc lora et juga subter
Provolvere rotae; crebro super ungula pulsu
Incita nec domini memorum proculcat equorum.

1. Parse fully, giving both syntax and accidence, the words—partibus, lauro, sonitum, quisque, vinci, turbine, provolvere, domini.
2. Give the present and perfect tenses indicative active and the supines of the verbs currunt, rumpuntur, excutit, effundit.
3. Explain the construction of "itur," and mention any other verbs that are used in the same way.

Section III.

Translate:—

"Saepe audivi a majoribus natu, qui se porro pueros a senibus audisse dicebant, mirari solitum C. Fabricium, quod, quum apud regem Pyrrhum legatus esset, audisset a Thessalo Cinea esse quemdam Athenis, qui se sapientem profiteretur, eumque dicere omnia, quae faceremus, ad voluptatem esse referenda. Quod ex eo audientes M'. Curium et Ti. Coruncanium optare solitos ut id Samnitibus ipsique Pyrrho persuaderetur, quo facilius vinci possent, quum se voluptatibus dedissent. Vixerat M.' Curius cum P. Decio, qui quinquennio ante eum consulem se pro re publica quarto consulatu devoverat: norat eumdem Fabricius, norat Coruncanius: qui quum ex sua vita tum ex ejus, quem dico, Decii facto judicabant esse profecto aliquid natura pulcrum atque praeclarum quod sua sponte peteretur quodque spreta et contempta voluptate optimus quisque sequeretur."

1. Parse fully, giving both syntax and accidence, the words—pueros, Athenis, omnia, Samnitibus, naturâ, voluptate.
2. Give the present and perfect tenses indicative active and the supines of the verbs dicebant, faceremus, persuaderetur, vixerat.
3. Explain why audisset, profiteretur, persuaderetur, peteretur, are in the subjunctive mood.

Section IV.

Translate:—

"Haec igitur lex in amicitia sanciatur, ut neque rogemus res turpes nec faciamus rogati. Turpis enim excusatio est et minime accipienda quum in caeteris peccatis tum si quis contra rem publicam se amici causa fecisse fateatur. Etenim eo loco, Fanni et Scaevola, locati sumus, ut nos longe prospicere oporteat futuros casus rei publicae. Deflexit jam aliquantulum de spatio curriculoque consuetudo majorum. Ti. Gracchus regnum occupare conatus est vel regnavit is quidem paucos menses. Num quid simile populus Romanus audierat aut viderat? Hunc etiam post mortem secuti amici et propinqui quid in P. Scipione effecerint sine lacrimis non queo dicere. Nam Carbonem quocumque modo potuimus propter recentem poenam Ti. Gracchi sustinuimus. De C. Gracchi autem tribunatu quid exspectem non libet augurari: serpit deinde res, quae proclivius ad perniciem, quum semel coepit, labitur."

1. Parse fully, giving both syntax and accidence, the words—sanciatur, casus, majorum, menses, Carbonem, perniciem.
2. Give the present and perfect tenses indicative active and the supines of the verbs prospicere, effecerint, queo, sustinuimus.
3. Explain why rogemus, fateatur, oporteat, effecerint, are in the subjunctive mood.

Section V.

1. What was the duty of the Censor? Mention any noted Censors. When was the office instituted, and when opened to the plebeians?
2. Give an account of Spurius Cassius, and of the Agrarian Law which made him famous.
3. What were the laws of the twelve tables? What was their general character?
4. Write a short history of Camillus.
5. What was the original Roman law of debt? How was it modified? and under what circumstances.
6. Give an account of the first Samnite war.

Section VI.

1. How was the Roman senate filled in ordinary times? Mention any special cases.
2. Give an account of Tiberius Gracchus.
3. What effect had slavery on Roman politics?
4. Give an account of the fall of Carthage.
5. Write a short history of Sulla.
6. In the time of Julius Cæsar was the aristocratic or the democratic party the champion of liberty? And why?

(*To be continued.*)

LEGAL POSITION OF INSTITUTIONS.

The following summary of the Literary and Scientific Institutions Act, 1854 (17 and 18 Vict., c. 112), was prepared for the Yorkshire Union of Mechanics' Institutes, and is published for the information of Committees of Institutes generally:—

Acquisition of Land.

Section 1.—Any person, being seised in fee simple, fee tail, or for life, of and in any manor or lands of freehold, copyhold, or customary tenure, and having the present beneficial interest therein, may grant, convey, or enfranchise, by way of gift, sale, or exchange, in fee simple, or for a term of years, any quantity not exceeding one acre of such land, whether built upon or not, as a site for any such Institution, as hereinafter described.

Section 33.—The Act shall apply to every Institution for the time being established for the promotion of science, literature, the fine arts, for adult instruction, the diffusion of useful knowledge, the foundation or maintenance of libraries or reading-rooms for general use among the

members or open to the public, of public museums, galleries of art, &c.

Section 5 enables equitable owners to convey without their trustees;—provides for grants of property belonging to infants and lunatics.

Section 6 enables corporations and trustees for public and other purposes to make grants.

Section 12 incorporates 13 and 14 Vict., c. 28:—"An Act to render more simple and effectual the Titles by which Congregations or Societies for Purposes of Religious Worship or Education in England and Ireland hold Property for such Purposes."

Section 13.—All grants, conveyances, and assurances of any site for an Institution under the provisions of this Act may be made according to the form following, or as near thereto as the circumstances will admit:—

"I, *or* We, [*or the corporate title of a corporation*] under the authority of an Act passed in the eighteenth year of Her Majesty Queen Victoria, entitled 'The Literary and Scientific Institutions Act, 1854,' do hereby freely and voluntarily, and without any valuable consideration [*or* do in consideration of the sum of to me, *or* us, *or* the said paid], grant and convey [*add, if necessary,* enfranchise] to all [*description of the premises*] and all [my, *or* our, *or* the right, title, and interest of the] to and in the same and every part thereof, to hold unto and to the use of the said and their successors, *or* of the said and his *or* their [heirs, *or* executors, *or* administrators, *or* successors], for the purposes of the said Act, and to be applied as a site for and for no other purpose whatever; such to be under the management and control of [*set forth the mode in which, and the persons by whom, the Institution is to be managed and directed; in cases where the land is purchased, exchanged, or demised, usual covenants or obligations for title may be added*]. In witness thereof the conveying and other parties have hereunto set their hands and seals, [*or* seals *only, as the case may be,*] this day of . Signed, sealed, and delivered by the said in the presence of ."

And no bargain and sale, or delivery of seisin, shall be requisite in any conveyance intended to take effect under the provisions of this Act, nor more than one witness to the execution by the conveying party.

Security of Property.

Section 20.—Where any Institutions shall be incorporated, and have no provision applicable to the personal property of such Institution, and in all cases where the Institution shall not be incorporated, the money, securities for money, goods, chattels, and personal effects belonging to the said Institution, and not vested in trustees, shall be deemed to be vested for the time being in the governing body of such Institution, and in all proceedings, civil and criminal, may be described as the moneys, securities, goods, chattels, and effects of the governing body of such Institution by their proper title.

Section 21.—Any Institution incorporated which shall not be entitled to sue and be sued by any corporate name, and every Institution not incorporated, may sue or be sued in the name of the president, chairman, principal secretary, or clerk, as shall be determined by the rules and regulations of the Institution, and, in default of such determination, in the name of such person as shall be appointed by the governing body for the occasion;

Provided, that it shall be competent for any person having a claim or demand against the Institution to sue the president or chairman thereof, if, on application to the governing body, some other officer or person be not nominated to be the defendant.

Section 24.—In any Institution the governing body, if not otherwise legally empowered to do so, may, at any meeting specially convened according to its regulations, make any bye-law for the better governance of the Institution, its members or officers, and for the furtherance of its purpose and object, and may impose a reasonable pecuniary penalty for the breach thereof, which penalty, when accrued, may be recovered in any local court of the district wherein the defendant shall inhabit, or the Institution shall be situate, as the governing body thereof shall deem expedient;

Provided always, that no pecuniary penalty imposed by any bye-law for the breach thereof shall be recoverable unless the bye-law shall have been confirmed by the votes of three-fifths of the members present at a meeting specially convened for the purpose.

Section 25.—Any member who may be in arrear of his subscription according to the rules of the Institution, or may be or shall possess himself of or detain any property of the Institution in a manner or for a time contrary to such rules, or shall injure or destroy the property of the institution, may be sued in the manner hereinbefore provided.

Section 26.—Any member of the Institution who shall steal, purloin, or embezzle the money, securities for money, goods, and chattels of the Institution, or wilfully and maliciously, or wilfully and unlawfully, destroy or injure the property of the Institution, or shall forge any deed, bond, security for money, receipt, or other instrument, whereby the funds of the Institution may be exposed to loss, shall be subject to the same prosecution, and if convicted, shall be liable to be punished in like manner, as any person not a member would be subject and liable to in respect of the like offence.

Section 31.—For the purposes of this Act, a member of an Institution shall be a person who, having been admitted therein according to the rules and regulations thereof, shall have paid a subscription, or shall have signed the roll or list of members thereof;

But in all proceedings under this Act no person shall be entitled to vote or be counted as a member whose current subscription shall be in arrear at the time.

Section 32.—The governing body of the Institution shall be the council, directors, committee, or other body to whom by Act of Parliament, charter, or the rules and regulations of the Institution, the management of its affairs is intrusted;

And if no such body shall have been constituted on the establishment of the Institution, it shall be competent for the members thereof, upon due notice, to create for itself a governing body to act for the Institution thenceforth.

Exemption from Local Rating.

By the 6 and 7 Vict., c. 36, intituled "An Act to exempt from County, Borough, Parochial, and other local Rates, Land and Buildings occupied by Scientific or Literary Societies," July, 1843, it is enacted:—

Section 1.—No person or persons shall be assessed or rated, or liable to be assessed or rated, or liable to pay, to any county, borough, parochial, or other local rates or cesses, in respect of any land, houses, or buildings, or parts of houses or buildings, belonging to any Society instituted for purposes of science, literature, or fine arts exclusively, either as tenant or as owner, and occupied by it for the transaction of its business, and for carrying into effect its purposes;

Provided that such Society shall be supported wholly or in part by annual voluntary contributions, and shall not, and by its laws may not, make any dividend, gift, or division, or bonus in money unto or between any of its members.

And provided also that such Society shall obtain the certificate of the barrister-at-law, as hereinafter mentioned.

Section 2.—Before any Society shall be entitled to the benefit of this Act, such Society shall cause three copies of all laws, rules, and regulations for the management thereof, signed by the president, or other chief officer, and three members of the council or committee of management, and countersigned by the clerk or secretary of such Society, to be submitted to the barrister-at-law appointed to certify the rules of friendly societies.

One of such copies, when certified by such barrister, shall be returned to the Society, another copy shall be retained by such barrister, and the other shall be trans-

mitted by such barrister to the clerk of the peace for the borough or county where the land or buildings shall be situate, and shall by him be laid before the recorder or justices for such borough or county at the general quarter sessions or adjournment thereof, held next after the time when such copy shall have been so certified and transmitted to him as aforesaid;

And the recorder or justices then and there present are hereby authorised and required, without motion, to allow and confirm the same.

And such copy shall be filed by such clerk of the peace with the rolls of the sessions of the peace in his custody, without fee or reward.

Section 4.—The fee payable to such barrister shall not, at any one time, exceed the sum of one guinea.

Section 5.—In case any such barrister shall refuse to certify the rules as aforesaid, the Society may submit them to the recorder or justices at quarter sessions, who shall and may, if he or they think fit, order the same rules to be filed.

Section 6.—Any person or persons assessed to any rate from which any Society shall be exempted by this Act, may appeal from the decision of the said barrister in granting such certificate as aforesaid to the said court of quarter sessions, within four calendar months next after the first assessment of such rate made after such certificate shall have been filed as aforesaid, or within four calendar months next after the first assessment of such rate made after such exemption shall have been claimed by such Society, such appellant first giving to the clerk or secretary of the Society in question, twenty-one days previously to the sitting of the said court, notice in writing of his intention to bring such appeal, together with a statement in writing of the grounds thereof, and within four days after such notice entering into a recognisance before some justice, with two sufficient sureties, to try such appeal at, and abide the order of the said court, and pay such costs as shall be awarded.

And the determination concerning the premises shall be conclusive and binding on all parties.

Raising a Building Fund.

In many places there are great difficulties in raising funds for a building for an Institute by donations. It may, therefore, be necessary to add to donations by small redeemable shares payable by monthly instalments. The following is a form of prospectus for that purpose:—

.... MECHANICS' INSTITUTION BUILDING COMPANY, LIMITED.

Capital, £.................., in ....Shares of £1 each.

Deposit, 1s. each Share.

Chairman.

....

Treasurer.

....

Directors.

THE COMMITTEE OF THE INSTITUTION.

It is proposed to raise a sum of £............... for the purchase of a site, and the erection of a building for the Mechanics' Institution, and other public purposes.

All donations and other sums of money available for a building shall be invested in paid-up shares, to be the property of the Institution.

All other shares to complete the amount required shall be paid by monthly instalments of one shilling each share, until the share be fully paid.

Shareholders shall be allowed interest at the rate of 5 per cent. per annum, to commence from the payment of the final instalment.

The Committee of the Institution shall from time to time, as they may be in possession of funds, be allowed to redeem the shares by payment of the full amount to the shareholders, and the shares redeemed shall be the property of the Institution.

In the event of the committee being able to redeem more shares than the shareholders shall offer for redemption, or if more shares be offered than the committee be able to redeem, the particular shares to be redeemed shall be determined by lot.

The building shall be commenced as soon as the required number of shares shall be subscribed for.

Donations to the building fund may be in money or shares.

Application for shares may be made to any member of the committee, or to

.... *Secretary.*

WEST LONDON INDUSTRIAL EXHIBITION.

The closing of this Exhibition was celebrated by a concert, held in the Floral Hall, Covent Garden, on Monday evening last. The choir of the London Choral Union gave their services on the occasion, as did also various well-known vocalists and instrumental performers.

During an interval of the concert, Mr. J. A. Nicholay, the chairman, accompanied by Mr. Morell, the secretary, and several members of the committee, appeared upon the platform to present their report to the meeting. From this it appeared that the exhibition was originated on a small scale in Marylebone; but, such was the desire manifested by those interested in it to send contributions to the intended collection, that efforts were made to obtain a large room, and so to increase the magnitude of the display. Failing in several applications to rent public halls, the committee determined to build a temporary place on a piece of vacant ground, but in this they were subject to the control of the Board of Works, and ultimately had to abandon the attempt and pay £100 as compensation. Then it was that, after some negotiation with Mr. Gye, they agreed to pay that gentleman £1,000 for the use of the Floral Hall for three months, and to give him also one-fourth of the proceeds of the exhibition. There were no fewer than 1,092 exhibitors. The inaugural ceremony was performed by the Right Hon. W. F. Cowper, First Commissioner of Works, assisted by the Archbishop of York and others. By the terms of their agreement, the committee were obliged to charge one shilling for admission, and to this they attribute a feeling approaching opposition by the working classes themselves, who considered they were practically excluded by this price. There was no counterbalance of patronage by the upper and middle classes, and at length the charge for admission was reduced to 6d. and to 3d. Music, given by amateurs of more than ordinary excellence, was introduced, and proved to be so great a source of attraction that the committee began to entertain sanguine hopes of success. Here (as stated in the report) the agents of the Duke of Bedford, the proprietor of the premises, interfered, and forbade the musical performances, alleging first that the holders of the neighbouring property objected, and, secondly, falling back upon the conditions of the lease to Mr. Gye. The hall, therefore, became silent, and was gradually almost deserted. The number of visitors who paid for admission during the three months was 84,253; the receipts from all sources were £1,800; the expenditure is estimated at £3,000. The committee therefore regret that necessity compels them to have recourse to the funds provided by the guarantors; and in concluding their report they thank those gentlemen and all who have rendered aid.

GOLD AND SILVER MONEY IN FRANCE.

The French writers on economical and financial subjects have recently collected much interesting information on the subject of the precious metals coined and in circulation, and on the exportation of gold and silver coin. It appears that during the period commencing with 1803 and ending with 1830 there were struck in France silver pieces, of the value of five francs each, to the amount of 2,241,416,740 francs, or £89,656,669 12s. In 1848 the stock of gold and silver in France was of the value of about 80 millions of francs in gold, and 2,150 millions in

silver coin; in 1856 it had risen to 2,304 millions in gold and to 2,576 millions in silver, or together about £195,200,000. A considerable reduction has to be made, however, from this total on account of the money which from various causes was re-coined. Between 1856 and 1865 the quantity of gold and silver in circulation was considerably diminished by French subscriptions to railways and other public works abroad, amounting to about a thousand millions of francs, by loans to foreign powers, by expenses in Algeria, Cochin China and other dependencies; by the outlay in the Isthmus of Suez; the purchase of Russian corn, and that of cotton; by the cost of the expeditions to Syria and Mexico; and by the drain caused by the war in America. The actual stock of gold and silver coin in circulation in France in 1864 has been estimated at about £120,000,000.

The import and export of the precious metals, including as it does a considerable quantity of uncoined metal, does not give an exact idea of the increase and diminution in the stock of money, and there is moreover a large amount carried from one country to another by private individuals which does not appear in the official returns. The total amount of gold and silver imported into France, during the period from 1846 to 1864, both included, was equal to £352,960,000, and the exports to £253,723,000, thus showing a large balance in favour of France. The elements for comparison with England are not before us, except for the period beginning with 1858 and ending with 1863, but it appears that during that time, while France received more than twelve hundred millions of francs in excess of her exportation, the imports of the precious metals into England exceeded the exports by rather less than a quarter of that sum. The amounts of the gold and silver in actual circulation in the principal states of the world in 1864 are estimated roughly as follow, in millions of francs:—

	1848.		1856.
France	2,230	...	4,886
England	1,260	...	1,665
United States of America	1,005	...	1,200
Holland and Belgium	642	...	642
Italy	425	...	605
Spain	450	...	575
Prussia	445	...	450
Austria	375	...	400
Russia	200	...	450
Sweden and Norway	225	...	225

The annual yield of all the gold and silver mines in the world is about a hundred millions of francs, of which the gold of Russia, Australia, and California, constitutes considerably more than half, and the silver of America nearly a quarter. Rather more than a quarter of the whole is employed in manufactures, and the rest is converted into money.

The enormous absorption of silver by the eastern states of the world is one of the most remarkable facts in the history of the precious metals. From the earliest historic times the East has taken little else but silver for its commodities. In the time of Pliny, the exportation of precious metals from the West was set down at from £80,000 to £100,000 a year. The Romans had their chief entrepot for the East in the Island of Taprobane, now called Ceylon, and they carried on a considerable commerce with the Indians, Persians, and Ethiopians; the shawls and stuffs of the East found their way to Europe long before the time of the crusades; the Arabs carried on a large and regular trade in these and other Asiatic productions, till the discovery of the Cape of Good Hope diverted the course of commerce; and the establishment of the overland route has operated to some extent in the other direction; but however and by whom the trade has been carried on, the flow of silver has been generally from the West towards the East. Humboldt calculated that in the year 1800, the amount of silver sent eastward annually was between five and six millions sterling. Between 1830 and 1853, the large amount of Sycee silver received from China, and the export of great quantities of English goods to India, disturbed the flow of silver eastward, which has, however, since set in with more determination than ever. In 1856, the balance in favour of the East was about six millions sterling. The exportation of the precious metals from Great Britain alone, during the seven years ending with 1858, was more than seven millions per annum, of which all but about one-eighth part was in silver. At the present time the balance of the imports and exports of gold and silver in favour of the East is calculated at from twelve to sixteen millions sterling per annum, or more than the total yield of all the silver mines in the world. The enormous production of gold in Australia and California has heretofore enabled the Western nations to part with their silver without great inconvenience, but the present rate of export of the latter seems to demand some new arrangement if any be practicable. Nearly all Orientals are given to hoarding. It is believed, says M. Villiaumé, the French economist, that the Egyptians hide away annually nearly four millions sterling. The Emperors of Morocco hold it a point of honour to fill as many chambers as possible with gold and silver; the present Emperor is said to have filled seventeen, and to have another in course of being filled. Morocco never parts with the money it receives; and it is said, on the faith of respectable witnesses, that more than 2,650 millions of francs (£106,000,000) are hoarded away in that country, and that the Emperor's treasure is of the value of at least £40,000,000.

Fine Arts.

Paris Schools and Exhibitions.—The works sent home by the pupils of the French Academy at Rome were exhibited publicly in the new rooms of the School of Fine Arts in Paris on the 17th instant, and were to remain on view until the 24th. The medals and decorations awarded by the jury of the Salon of the present year, and the prizes gained by the pupils in the Ecole des Beaux-Arts, were distributed on the 14th instant by the Minister of the Fine Arts, supported by the various officers connected with the administration of the galleries of art, and the members of the various juries. M. Nanteuil, of the Institute, and M. Amaury Duval, painter, were promoted to the grade of officers of the Legion of Honour; and Messieurs Moreau, sculptor; Langée, Hillemacher, De Curzon, G. R. Boulanger, Chaplin, Protais, and De Winne, of Belgium, painters, were made chevaliers of the same order. In his speech on the occasion, the Minister spoke in high terms of the works exhibited by foreign painters at the last Salon, but claimed for the French School decided superiority in sculpture. He exhorted artists not to be led away by the public taste for works of a secondary character, far too numerous at present, but to give more attention and to lead their pupils to the study of higher art and the cultivation of pure taste. The Minister announced also that in future the productions of the pupils of the schools of Paris and Rome would be exhibited not only, as at present, in the galleries of the Ecole des Beaux-Arts, but also at each succeeding annual exhibition. M. Robert Fleury, Director of the New School of Fine Arts, gave a highly satisfactory account of the progress of that establishment. He referred to the ateliers for painting, sculpture, architecture, and line and medal engraving, and said that they were all in full operation and well attended; that there were evening classes for the study of design; that the number of courses had been increased, and that professors and pupils generally exhibited remarkable zeal. He announced the opening of a large lecture theatre; the commencement of courses of instruction in science applied to the arts, in order to afford young architects a knowledge of the physical laws affecting the materials required in their profession; the establishment of spacious galleries containing

casts from the antique; and the opening of the library of the school. The Commission of the Universal Exhibition of 1867 has given notice to industrial artists, decorative painters, cameo engravers, lithographers, sculptors, decorators, and others, to apply immediately for the space they desire to secure at the Exhibition. The Committee of Admission for this class consists of M. Berrus, shawl designer; M. Braquenie, carpet manufacturer; M. Diéterle, decorative artist; M. Delamarre; M. Labouret, architect; M. Ed. Taigny, maître des requêtes. The gallery at the Luxembourg has been re-arranged, and was re-opened the other day to the public. The following recent acquisitions have been added to the collection:—"Amymoné carried off by Naiads," Giacomotti; "Communion of the Apostles," E. Delaunay; "Saint Jean de Dieu, founder of the order of that name," E. Lafon; "Tobias and the Angel," Gustave Doré; "Hunting in the marshes of Berry," Busson; "Saint Sebastien," Ribot; "A Fête at Genazano," Archenbach; "A charge of artillery," Scheyer; "The Chase," Aligny; "A landscape," Mademoiselle Sarazin de Belmont; "The Infancy of Bacchus," Ranvier; "A marine piece," M. de Valdrome; "The labourer and children," Duverger; "Les Précieuses Ridicules," Vetter; "Lacemakers at Asnières-sur-Oise," Paul Soyer; "Evening Prayer in the Sahara," Guillaumet. With the exception of the last-named picture, the whole of the above were purchased from the Salon of the present year.

Sale of the Essingh Collection.—A celebrated collection of works of art and curiosity, that of the late Mr. Antoine Joseph Essingh, of Cologne, is announced for sale in September, commencing on the eighteenth of the month. Mr. Essingh spent a portion of his life in France and the rest in Prussia; he was originally a member of a commercial firm of high standing in Cologne, that of H. J. Essingh and Co., but retired early, and gave himself up entirely to matters of art. The catalogue includes considerably more than two thousand items. There are some very fine engravings; a curious collection of illuminated manuscripts and miniatures; rare examples of German, Venetian, and other glass; china, *faïences*, and pottery, of all countries; some fine enamels; a large collection of Chinese and Japanese productions; carved works in ivory, wood, and stone; a few Greek and Roman antiquities; some remarkably fine specimens of painting on glass; ancient arms, embroidery, furniture, and miscellaneous articles. The pictures are more than 300 in number, and include examples of nearly all the schools—Italian, Spanish, German, Dutch, Flemish, and French.

A Picture by Leonardo da Vinci, of the originality of which the owner has no doubt, is now in possession of Mr. C. F. Dennet, of Ladbroke-square, a member of the Society, who is desirous of submitting it to the notice of connoisseurs and others interested in the formation of public or private galleries. The subject is "The Daughter of Herodias receiving the head of John the Baptist."

Manufactures.

Mineral Statistics for 1864.—The statistical tables of the produce of the mines of the United Kingdom during the past year have been lately published, having been prepared under the direction of Mr. Robert Hunt, F.R.S. It appears that during 1864, 3,268 collieries in Great Britain and Ireland produced 92,787,873 tons of coal. Of this quantity, 8,800,420 tons were exported, being an increase of 525,208 tons over the exportations of the preceding year. There were 2,351,342 tons brought to London in 1864, and 1,786,713 tons in 1863. 10,064,890 tons of iron ore were produced from the mines of this country, and there were imported 75,194 additional tons. The total quantity fed 612 blast-furnaces, which produced 4,767,951 tons of pig-iron. There were exported 465,951 tons, and the rest was worked up at 127 iron-works, where 6,262 puddling furnaces were in action, and 718 rolling-mills. The 192 mines in the South-West of England, and the 30 distributed over other parts of the United Kingdom, produced 214,604 tons of copper ore, which yielded 13,302 tons of metallic copper. The produce of lead ore, principally galena, was 94,433 tons, which yielded 91,283 tons of lead, and 641,088 ounces of silver. Of zinc ores, nearly all being the sulphide of zinc, 15,047 tons were obtained, producing 4,040 tons of metal. Of iron pyrites, used in our sulphuric acid and soda works, there were procured 94,458 tons. The tin mines produced more tin in 1864 than in any previous year; 15,211 tons were raised, which yielded 10,108 tons of metallic tin. During 1864, gold was obtained from five mines in Merionethshire. These produced 2,336 tons of auriferous quartz, which yielded 2,887 ounces of gold; and it is stated that, in consequence of various improvements in amalgamation, due to Mr. W. Crookes, it is highly probable that the production of British gold will be considerably increased during the current year. The gross value of the foregoing mineral products was £39,979,837.

Colonies.

Agriculture in South Australia.—The approximate agricultural statistics for the year ending the 31st March, 1865, are as follows:—During the year there has been an increase in the number of holdings exceeding one acre of 743; a total increase in the quantity of freehold land alienated from the Crown of 462,264 acres; and a decrease in the quantity of rented land occupied of 14,056 acres. There is an increase in the extent of enclosed land of 786,036 acres; and a decrease in the quantity under tillage of 31,352 acres. Coming to the yield of the following descriptions of crops, it appears that, as compared with the previous year, wheat shows an increase of 521,971 bushels; oats show a decrease of 835,753 bushels; barley a decrease of 13,848 bushels; maize a decrease of 28,914 bushels; rye and bere an increase of 2,278 bushels; and peas, beans, millet, and sorghum an increase of 22,354 bushels. On the crop of cereals, peas, and beans there is a total comparative deficiency of 331,932 bushels, chiefly caused by the large falling off in oats. In green crops there has been an increase as compared with the previous year of 17,754 tons, consisting chiefly of potatoes. In hay there is an increase of 24,265 tons. Onions show a falling off of 398 cwt. There is an increase in the number of vines planted of 1,247,728, but a decrease in the quantity of grapes gathered and made into wine or brandy of 2,797 cwts.; and there is also a falling off in the quantity of grapes made into wine or brandy of 1,181 cwts.; and there is also a decrease in the quantity of wine produced of 15,691 gallons, but an increase in the quantity of brandy manufactured of 195 gallons. The average yield of wheat throughout the colony has been 14·7 bushels to the acre; of oats, 18·5 bushels; of potatoes, 1·9 ton; and of hay, 1·1 ton.

Cotton in Queensland.—A colonial journal says that the success of cotton growing has this year surpassed all previous experience in the colony. The crop is good in quantity, and the quality excellent. The upland variety appears almost to have superseded the Sea Island in cultivation, a change probably owing to an equalisation of the bonus on either kind, and to the prevailing impression that the latter is hardier and therefore better able to stand the chances of the season. Legislative sanction to payment of a bonus of £10 in land orders on every 300 lbs. net ginned cotton will expire in December next, but it is to be hoped it will be renewed at least for a year or two to create fresh encouragement owing to the losses during the last season.

Finance in Victoria.—The Legislative Assembly has sanctioned a loan of £250,000. This amount was rendered necessary by the works on the Geelong line, which

was in very bad repair when it passed into the hands of Government. A loan of £500,000 has also been sanctioned for water supply for the colony generally. Of this amount £50,000 will be handed over to the West Commissioners for Ballarat, to complete their works. £150,000 will be set apart for the supply of Geelong, and the scheme for the service of the districts between Malmsbury and Epsom is estimated to cost £320,000.

New Fruit in Queensland.—Samples of the fruit of the Flacourtia, a tree not at present cultivated to any extent in this colony, have recently attracted attention. The fruit grows in clusters, something like the grape, and is nearly the size and colour of the black-heart cherry. The flacourtia is stated to be an evergreen shrub, or small tree, growing to the height of 10 feet. It is a native of the East Indies, and perfectly hardy in Brisbane, where it produces its fruit in great profusion. Being covered with a vast number of long thorns, it is well calculated for hedge planting, as it would, if properly trained when young, resist with equal success the attacks of both men and cattle. In its unripe state the fruit is astringent, and in taste somewhat resembles the wild sloe, but as it gets ripe it becomes of a very agreeable flavour. It ripens during April and May. It may be propagated by seeds, layers, and cuttings, the former being the most ready method. It may be planted in any average good garden soil at 10 feet distances, and, with very little trouble, will form a handsome shrub. The foliage being a dark green, and the young shoots a reddish brown, the effect is very good. There are other varieties, which are said to produce larger fruit, but they are not sufficiently known to warrant an opinion as to their quality and productiveness.

Notes.

Social Science Congress.—The fourth session of the Congress to aid the progress of the social sciences, is announced to commence at Berne on the 28th inst., and to terminate on the 2nd of September. The committee announces that the subscription of members is 20 francs per annum, and that the card of membership not only confers the right of participating in the labours of the Congress, but gives the bearer the further advantage of a reduction of one-half the usual rates of conveyance by the Chemin de Fer de l'Est of France. MM. Guillaumin and Co., 14, Rue Richelieu, are authorized to grant cards of membership, but no London agent of the committee is named in the announcement.

Quekett Microscopical Club.—This club, which is under the presidency of Dr. Edwin Lankester, F.R.S., has been established for the purpose of affording to microscopists, in and around the metropolis, opportunities for meeting and exchanging ideas without that diffidence and constraint which an amateur naturally feels when discussing scientific subjects in the presence of professional men. In the prospectus the promoters say:—"The want of such a club as the present has long been felt, wherein microscopists and students with kindred tastes might meet at stated periods to hold cheerful converse with each other, exhibit and exchange specimens, read papers on topics of interest, discuss doubtful points, compare notes of progress, and gossip over those special subjects in which they are more or less interested; where, in fact, each member will be solicited to bring his own individual experience, be it ever so small, and cast it into the treasury for the general good. Such are some of the objects which the present club seeks to attain. In addition thereto it hopes to organize occasional field excursions, at proper seasons, for the collection of living specimens, to acquire a library of such books of reference as will be most useful to inquiring students; and, trusting to the proverbial liberality of microscopists, to add thereto a comprehensive cabinet of objects." The ordinary meetings of the club are to be held on the fourth Friday of every month, at eight o'clock in the evening, at 32, Sackville-street, Piccadilly. In order to place the advantages of this club within the reach of all, the annual subscription has been limited to ten shillings, without entrance fee. The Secretary, Mr. W. M. Bywater, will furnish all further particulars upon application by letter, addressed to 192, Piccadilly, W.

Scholastic Registration.—A committee of schoolmasters, appointed to consider this subject, has issued a circular-letter containing the principal provisions of the proposed "Scholastic Registration Bill," and giving a statement of the success which the movement in favour of it has already secured. The committee wishes to be prepared to assure the Government and the Legislature that schoolmasters generally are favourable to a Registration Act, and that while they desire to maintain the independence of their profession, and to promote its efficiency, they are equally anxious to advance the interest of education. Signature-sheets, therefore, accompany the letters, to be signed by those who are favourable to the principle of registration. The committee has unanimously resolved, after careful and long deliberation, to withdraw the clause which would prevent an unregistered person from recovering fees in a court of law, and to suggest that any penal enactment be restricted to the assumption by any unregistered teacher of such a title as would signify that he had been registered. The Hon. Secretary to the committee, Mr. Barrow Rule, of Aldershot, will be happy to give further information to any who may apply for it.

Memorial to the late Sir Joseph Paxton.—A Committee, which includes the Duke of Devonshire, the Duke of Sutherland, Earl Granville, Viscount Palmerston, the Right Hon. W. E. Gladstone, M.P., and many other influential names, has been formed for raising the necessary funds to erect a monument to perpetuate the memory of Sir Joseph Paxton. It is thought that no memorial can be more appropriate than a statue in marble, to be placed in the garden of the Crystal Palace at Sydenham. A most eligible site for this purpose presents itself, in the midst of the beautiful landscape garden with which Paxton's genius and name are so closely associated, and within sight of the Palace itself, and of the residence in which he passed a great part of the last ten years of his life. It is proposed to entrust the execution of the statue to Mr. Spence, of Rome, to whom Sir Joseph sat for a bust within a few months of his death. A general subscription list will be opened and contributions received, which may be of any amount so as to embrace a large number of subscribers, and thus give the memorial as wide and popular a character as possible. Subscriptions, with the name and address of the sender, are requested to be forwarded to Geo. Grove, Esq., Crystal Palace, Honorary Secretary, to whom all cheques and post-office orders may be made payable and postage stamps transmitted. Subscription lists have also been opened at the London and Westminster Bank; the London Joint Stock Bank; the London and County Bank; the Union Bank of London; Messrs. Coutts and Co.; Messrs. Drummond's; and Messrs. Herries, Farquhar, and Co.

Honour to Science.—The Emperor of the French has lately nominated Mr. Claudet a *Chevalier de la Légion d'Honneur*. Mr. Claudet is one of the oldest members of the Society of Arts, is a Fellow of the Royal Society, and is well-known as the introducer of the Daguerreotype into this country and for his discoveries in connection with it, especially the use of chloride of bromine in the process, by means of which its rapidity was increased one hundred-fold. This discovery was communicated to the Royal Society in 1841, and it then became generally known and adopted. The increased facility thus afforded to the practice of the art helped mainly to bring it so largely into use.

Relief in Cancer.—It is stated that Dr. Brandini, of Florence, has discovered a real alleviation for the torments caused by this malady. In his account of his discovery he says that one of his patients, aged 71, at the

hospital of Santa Maria della Scala, being afflicted with cancer on the tongue, in the midst of his torments asked for a lemon, the juice of which almost immediately diminished the pain. The patient, on finding this, asked for another on the following day, and it gave him still greater relief than before. This led Dr. Brandini to try citric acid itself, in a crystallised state. A gargle was composed of 4 gr. of the acid in 350 gr. of common water, and it entirely carried off the pain; on its reappearing the same remedy was repeated with the same success. In the course of a month this treatment not only delivered the patient from all suffering, but even reduced the swelling of the tongue very considerably. Dr. Brandini had also tried the same remedy in other cases with similar results.

The Emperor's Prize.—The grand prize given by the Emperor for the annual competition of the pupils of the Lycées, or high schools, of Paris and Versailles, is not a mere honorary award, but carries with it substantial benefits; the fortunate winner of it receives a large gold medal, on which his name and the object for which it was given are engraved, and also a copy of the Latin classics, splendidly bound, impressed on the sides with the Imperial arms, and with a special inscription. The Laureate is, moreover, relieved from the conscription—the cost of a substitute being at present 2,300 francs—and he may go through all the studies of the law, medicine, or other schools, without any expense whatever—privileges equal in value to from fifty to sixty pounds a year.

Correspondence.

Ventilation.—Sir,—The note in your last number on this subject does not lead to any very decided solution of the great problem of how to keep down the temperature of public buildings, or how to furnish a dense crowd with pure air without introducing disagreeable or even dangerous drafts. All the endeavours of General Morin confessedly failed, and the double envelope proposed by M. Regnault would only have the effect of slightly lowering the internal temperature when the buildingis exposed to the intense heat of the sun, in no way conducing to the supply of pure air, and a mode of construction that would be of no avail during the night hours. Continued watering of the roof is a most vicious plan, because it tends to check the natural alacrity of heated air to rise. As long as we insist on having our ceilings made air-tight with lath and plaster, or otherwise, we shall discover no real or permanent remedy for the heat, stifling air, and water running down the walls of our public buildings, a certain sign of the absence of ventilation, when crowded with human beings. Our courts of law and justice are wretched examples of either total absence of ventilation, or of such miserable expedients as amount to nothing. Their state is much aggravated because the mephitic vapour exhaled by raving counsel, anxious clients, prosecutors, criminals and witnesses, is far greater than under ordinary circumstances. Let the ceilings be of lath only, without the plastering, and so construct the roof as to render it a ventilator throughout every portion of it, then the foul and heated air will rise bodily from the whole area of the room and disperse itself in the atmosphere, while no water will be found running down the walls into pools on the floor as I have frequently seen it. Fresh air is sure to find its way in somewhere, or at any rate a band of perforated zinc several feet broad all round the four walls of the room at a proper height from the floor, would ensure that object. I speak from experience, having been present at a ball, given in the hottest season, in an unfinished building of which the ceilings were only lathed—not plastered—and, notwithstanding the lights and company, the atmosphere of the rooms was as cool as the outward air.—Henry W. Reveley.

Patents.

From Commissioners of Patents Journal, August 18th.

Grants of Provisional Protection.

Bags, travelling and other—2001—H. Frankenburg.
Brewing, distilling, and drying yeast—2019—P. Robertson.
Bridges, sliding or rolling—1934—M. Kenney.
Coke ovens—2013—W. Morgans.
Electric telegraphic apparatus—2047—L. J. Crossley.
Fire-arms, breech loading—2063—S. Law.
Fog horns, securing the tongues or reeds of—2011—W. H. Brookes.
Gunpowder, unexplosive—2057—J. Gale.
Gun wipers—2031—A. V. Newton.
Horse shoes, &c., machinery for making—2017—L. Anderson.
Letters, &c., transportation and delivery of—2049—A. V. Newton.
Motive power engine, &c., apparatus applicable as a—2021—W. Clark.
Numerical registering machine—2035—S. Buxton.
Paints—2015—E. L. Ransome.
Printing in colours, machinery for—1978—A. Applegarth.
Railway carriages—1746—L. Faure.
Railway carriages and trains, retarding or stopping—2045—J. Mead.
Railway carriages and wagons, self-acting coupling for—2037—T. Smith and J. Brook.
Railways, signalling on—2000—J. Pickin and R. Bailey.
Railways, signals for—2009—E. S. Horridge.
Revolver pistols—2027—H. A. Bonneville.
Roads, steam locomotion on—1002—W. E. Gedge.
Salts, &c., manufacture and applying of—1905—J. H. Chaudet.
Screw threads on pipes, portable machine for cutting—2055—T. G. Messenger.
Sewing machines—1904—A. Smith.
Sewing machines—2067—B. Russ and E. Gandell.
Sewing machines, binders for—2033—G. B. Woodruff.
Ships' boats, sustaining and lowering—2041—C. H. Simpson.
Slide valves, relieving of back pressure—1069—J. W. Longstaff.
Steam, generating—2051—M. P. W. Boulton.
Submarine telegraphic cables—2025—F. G. Mulholland.
Sugar, &c., filtering—2023—J. A. Leon, G. Tessimond, & J. Kissack.
Water, raising of—1918—W. E. Gedge.
Weaving, looms for—2061—T. R. Shaw.
Yarns and fabrics, printing and dyeing—2053—J. Buchanan & R. Boyd.

Invention with Complete Specification Filed.

Grain and seed, apparatus for ascertaining the quality and condition of—2098—W. Bunger.

Patents Sealed.

484. C. Baulch.	523. S. W. Worssam.
493. J. Hulley.	526. J. Hundy.
494. J. Dodgeon, J. Gaukroger, and W. Shackleton.	529. J. Badcock.
	534. F. Claudet.
498. J. Carter.	569. J. B. Toussaint.
499. G. N. Shore.	657. R. Mushet.
500. J. Nicholas.	658. E. Carchon.
501. M. P. W. Boulton.	1318. G. Haseltine.
502. D. Barr.	1422. C. T. Moller.
510. J. G. Hughes.	1499. W. E. Newton.
511. S. Saville.	1595. G. Haseltine.
516. J. Jacob and R. Pilzinger.	1609. A. E. Brae.

From Commissioners of Patents Journal, August 22nd.

Patents Sealed.

504. G. Sinclair.	551. R. Barclay.
518. C. W. Lancaster.	559. J. M. Hart.
524. J. Shortridge.	568. T. S. Hall.
525. C. J. Rowe.	581. J. Park.
531. E. P. H. Gondouin.	663. W. J. Dorning.
532. T. Routledge and T. Richardson.	690. T. Whitehead and H. W. Whitehead.
533. J.H.Rawlins & J.Chappell.	692. E. B. Wilson.
537. J. Askew.	708. F. A. Braendlin.
541. R. Smyth.	736. J. Ramsbottom.
542. C. Whiting.	1282. R. H. Tweddell.
548. M. B. Nairn.	1631. J. H. Johnson.
550. T. W. Roys and G. A. Lilliendahl.	1677. W. E. Newton.

Patents on which the Stamp Duty of £50 has been Paid.

2305. J. H. Johnson.	2327. W. Whittle.
2307. H. Garside.	2344. W. Barrett.
2326. J. G. Tongue.	2398. J. Davis.
2331. J. Standish.	2357. M. K. Angelo.

Registered Designs.

An Improved Bottle Top and Cork-screw—August 11—4735—T. Heeley, 73, Graham-street, Birmingham.
Tool Holder—August 18—4736—Smith and Coventry, Gresley Iron Works, Manchester.
Stand, or Support, for Crinoline, or Fire-guards and Banner-screens—August 22—4737—R. W. Winfield and Co., Birmingham.

THE

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THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, SEPTEMBER 1, 1865. [No. 667. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Examinations for 1866.

The Programme of Examinations for 1866 is now published, and may be had gratis, on application to the Secretary. A copy has been forwarded to each Institution and Local Board.

Proceedings of Institutions.

Hyde Mechanics' Institution.—The thirteenth annual report says that during the year more than 200 useful works have been added to the library. The Hyde Book Club has again proved a useful feeder to this library, and has contributed its quota towards enlargement, whilst the remainder have been added by private gifts, or by purchase. The collection now approaches 1,900. A new catalogue has been compiled at some considerable trouble and expense. The last report recorded an increase of 50 per cent. in the number of members of the Hyde Book Club; notwithstanding the improvement, however, it was resolved to completely alter the system of management. It has been arranged to abolish the rotation of books, and to establish a book store at the Mechanics' Institution library; to allow members to make their exchanges there at pleasure; to consult the whole of the club as to the choice of books; to issue a quarterly list; and to connect the club with Mudie's Library, so as to have constantly in circulation a proportion of the very newest works. The new plan has resulted in an addition of 25 per cent. of new members. The Elementary Classes have not quite kept up to the numbers and receipts attained to the previous year, which was a nearly four-fold increase upon the preceding one. The attendance has been somewhat interfered with by the precarious nature of trade in the district, and by the opening of several rival classes. French and German Classes have been opened, and the attendance, though small, is very regular. The lecture course has been on the whole well attended and successful, and the committee having charge of this section have been enabled to hand over a surplus to the Institution funds of nearly £18. Encouraged by the support given to the first flower show, the directors resolved to hold a second, upon a more liberal plan. The exhibition resulted, however, in a small loss to the Institution. The success of the day school has been satisfactory. There has been a steady increase in the numbers, and the receipts paid by the teacher for accommodation prove a small auxiliary to the funds of the Institution. The efforts made by the directors to establish annual flower shows of a superior character, have led to the formation of a "Cottage Gardeners' Association" in connection with the Institution, and a considerable number of members have been enrolled. Besides paying off a small debt, due to the treasurer at the commencement of the year, of £6 1s. 2½d., the directors have been enabled to meet the various charges of the year, to extend the working of several of the departments of the Institution, and to announce a balance in the hands of the treasurer of £24 11s. 3d., the income having been £250 18s. 5d.

EXAMINATION PAPERS, 1865.

(*Continued from page* 638.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

FRENCH.

THREE HOURS ALLOWED.

Part I.

Candidates for a Third-class Certificate are requested to translate into English the following extract, and to answer the grammatical questions thereto annexed, in the order in which they are placed. This first Part is all that will be expected of them.

Translate into English:—

L'Ermite Pierre traversa l'Italie, passa les Alpes, parcourut la France et la plus grande partie de l'Europe, embrasant tous les cœurs du zèle dont il était dévoré. Il voyageait monté sur une mule, un crucifix à la main, les pieds nus, la tête découverte, le corps ceint d'une grosse corde, couvert d'un long froc et d'un manteau de l'étoffe la plus grossière. La singularité de ses vêtements était un spectacle pour le peuple; l'austérité de ses mœurs, sa charité, la morale qu'il prêchait, le faisaient révérer comme un saint.

Il allait de ville en ville, de province en province, implorant le courage des uns, la piété des autres; tantôt il se montrait dans la chaire des églises, tantôt il prêchait dans les chemins et sur les places publiques. Son éloquence était vive et emportée, remplie d'apostrophes véhémentes qui entraînaient la multitude. Il rappelait la profanation des saints lieux et le sang des Chrétiens versé par torrents dans les rues de Jérusalem; il invoquait tour à tour le ciel, les saints, les anges, qu'il prenait à témoin de la vérité de ses récits; il s'adressait à la montagne de Sion, à la roche du Calvaire, au mont des Oliviers, qu'il

faisait retentir de sanglots et de gémissements. Quand il ne trouvait plus de paroles pour peindre les malheurs des fidèles, il montrait aux assistants le crucifix qu'il portait avec lui; tantôt il se frappait la poitrine et se meurtrissait le sein, tantôt il versait un torrent de larmes.

Le peuple se pressait en foule sur les traces de Pierre. Le prédicateur de la guerre sainte était partout reçu comme un envoyé de Dieu; on s'estimait heureux de toucher ses vêtements; le poil arraché à la mule qu'il montait était conservé comme une sainte relique. A sa voix les différends s'apaisaient dans les familles, les pauvres étaient secourus, la débauche rougissait de ses excès; on ne parlait que des vertus de l'éloquent cénobite; on racontait ses austérités et ses miracles; on répétait ses discours à ceux qui ne les avaient point entendus et qui n'avaient pu s'édifier par sa présence.

Michaud, "*Histoire des Croisades.*"

1. Parse the first two sentences of the above extract.
2. Write the five primitive tenses of all the verbs contained above, each verb to be given in a separate line.
3. Put the article and a suitable epithet before each of the following nouns, so as to show its gender:—*Exercice, zèle, arbre, feuillage, dent, rage, peur, tonnerre, nef, crépuscule.*
4. Give the adjective that corresponds to each of these substantives which occur in the extract:—*Cœur, main, corps, singularité, austérité, mœurs, ville, province, courage, piété, église, lieu, sang, ciel, ange, guerre, poil, voix, excès, vertu, miracle.*
5. What remark does the spelling of *voyageait* suggest (4th line of the extract)?
6. What peculiarities of orthography are there in the conjugation of such verbs as *avancer, essayer, révéler, appeler, rejeter?*
7. *Les pieds nus* (4th and 5th lines). There is another way of expressing *bare-footed* in French. State how this other construction affects the article and the spelling of *nus*. To what other adjective does the same rule apply?
8. Explain the spelling of the past participle *entendus* in the last line but one.
9. *Le poil arraché à la mule*, &c. The preposition *à* will here be rendered by "from." Can you name other verbs after which the preposition *à* is thus used, instead of *de?*
10. *Les différends s'apaisaient dans les familles* (sixth line from the end). Show by several similar examples how much more frequently the reflective voice is used in French than in English.
11. Write, with all their variations of form, according to gender and number, the words which correspond in French to *my, thy, his, her, its, our, your, their; mine, thine, his, hers, its, ours, yours, theirs.*
12. Give, with suitable examples, *any three* important rules on the syntax of the verb in French, comparing or contrasting that language with your own as much as possible.
13. Write the French names of:—1. The most common animals, domestic and others; 2. Flowers and vegetables; 3. Trees and fruits; 4. The principal pieces of furniture of a house; 5. The most common metals and minerals.
14. Conjugate the preterit, the imperative, and present subjunctive of the verbs *devenir, se repentir, se prévaloir,* and *mettre.*

Part II.

Candidates for a Second-class Certificate are to answer the questions Nos. 9, 10, 11, and 12 in Part I., together with those in Part II., and to translate the English extract and idiomatic expressions which follow.

1. What is the exact purpose of the pronoun *vous* in the following quotation?

Maint estafier accourt; on *vous* happe notre homme,
On *vous* l'échine, on *vous* l'assomme.

La Fontaine.

2. Explain and correct the mistake in the following construction of the pronoun:—Il n'entendra pas raison, il n'a jamais voulu *l*'entendre.

Si vous voulez qu'on vous rende justice, rendez-*la* aux autres.

3. Give, with examples, all the rules for the use of the subjunctive mood in French.
4. What is the difference of meaning implied by the difference of spelling in these two expressions?

Le peu de bonté qu'il m'a *montré*......
Le peu de bonté qu'il m'a *montrée*......

Complete the sentence in each case.

Translation:—

As Sir Roger is landlord to the whole congregation, he keeps them in very good order, and will suffer nobody to sleep in it besides himself; for if by chance he has been surprised into a short nap at sermon, upon recovering out of it he stands up and looks about him, and if he sees anybody else nodding, either wakes them himself, or sends his servants to them. Several other of the old knight's particularities break out upon these occasions. Sometimes he will be lengthening out a verse in the singing Psalms half a minute after the rest of the congregation have done with it; sometimes, when he is pleased with the matter of his devotion, he pronounces "Amen" three or four times to the same prayer; and sometimes stands up, when everybody else is upon his knees, to count the congregation, or see if any of his tenants are missing. This authority of the knight, though exerted in that odd manner which accompanies him in all circumstances of life, has a very good effect upon the parish, who are not polite enough to see anything ridiculous in his behaviour; besides that, the general good sense and worthiness of his character make his friends observe these little singularities as foils, that rather set off than blemish his good qualities. As soon as the sermon is finished, nobody presumes to stir till Sir Roger is gone out of the church. The knight walks down from his seat in the chancel between a double row of his tenants, that stand bowing to him on each side, and every now and then inquires how such a one's wife, or mother, or son, or father do, whom he does not see at church; which is understood as a secret reprimand to the person that is absent.

Addison.

Idioms:—

1. Tenez-le vous pour dit.
2. Il ne sait où donner de la tête.
3. Il nage entre deux eaux.
4. Je n'ai pas mes coudées franches.
5. Ils travaillent à qui mieux mieux.
6. On lui a coupé l'herbe sous le pied.
7. Poussez-leur l'épée dans les reins.
8. Vous n'y allez pas de main-morte.
9. J'en ai de reste.
10. Nous sommes logés à la même enseign
11. Prenez la balle au bond.
12. Je suis des vôtres.

Part III.

Candidates for a First-class Certificate are expected to translate the above idioms and the extract (down to "are missing" only), and to answer, *in French*, the grammatical questions Nos. 1, 2, and 4 (Part II.), as also the following:—

Literature.—1. State what you know of either Rollin or Bayle.

2. Give a short account of any one work of Fénelon, Massillon, or Louis Racine.

History.—Write a *résumé* of the last fifteen years of the reign of Louis XIV.; or, if you prefer it, dwell at some length upon any one important event of that period.

(*To be continued.*)

MUSICAL FETE AT DRESDEN.

During the early part of the week ending 29 July last, the town of Dresden was thrown into a state of excitement by a "Sänger Fest," or Monster Choral Meeting, of a magnitude unprecedented in this or perhaps in any other

country. A building somewhat resembling in style those that have been raised of late years in England and elsewhere for industrial exhibitions, and capable of containing about 26,000 persons, had been constructed, on purpose for the occasion, on the right bank of the Elbe, about a mile from the town. Being intended for a music hall, it was built of wood, and the interior was decorated with paintings and transparencies illustrative of German history and art. Nearly one-half of the ground-floor was occupied by the orchestra, calculated to contain 12,000 singers, besides the instrumental performers, the remainder of the space being left to the audience, for the upper classes of which were also galleries, which ran round the greater part of the building. The exits and entrances, as well as the ventilation, were admirably managed, so that, notwithstanding the heat of the weather, little inconvenience was felt from it, as any spectator who wished to go into the open air could easily do so from any part of the building. The singers, who were to take a part in this great national festival had been invited from every clime and region where Germans are to be found. Each of these choral bands was preceded in the great procession by a silk banner, showing whence they came; and on these might be read, not only countries like Hungary, Schleswig-Holstein, and others bordering on Germany, but Australia, New York, Cincinnati, and even China.

All these choral societies had been supplied with the music and parts which they were expected to sing, and thus, as they came prepared, it was not so impracticable as might have been expected for the conductor to direct the vocalization of this monster chorus.

On Monday, which was the great day of the Festival, the singers assembled under their respective banners in a central place in the town, near the residence of the Minister, M. de Beust, and thence they walked eight abreast in procession through the principal streets and over the bridge to the great Music Hall. The streets were admirably kept, no carriage being allowed in those through which the procession passed, and some idea of their numbers may be formed from the fact that, although marching quick step, and with little incidental interruption, the procession occupied four hours and a half in filing past. Notwithstanding the cheers and the flowers with which they were greeted from almost every window under which they passed, and the more substantial solace of beer offered them from many an open door, the greater part of them must have been greatly oppressed with heat, dust, and fatigue before they reached the Music Hall. Nevertheless they sang lustily through the evening, and the effect of some of the National German ballads, sung by eleven or twelve thousand voices in chorus will not easily be forgotten by any one present who had any feeling for music.

PARIS UNIVERSAL EXHIBITION OF 1867.

The Imperial Commission has issued a series of regulations concerning the important section of the Exhibition which is devoted to objects specially connected with the amelioration of the physical and moral condition of the population—such as, the means and methods of infant education: books, and other means, for adult and family education; economic furniture, clothing, and articles of food; popular and working costumes; cheap habitations; implements, tools, processes, &c. These regulations only apply to French exhibitors, but they furnish hints for all the world.

Seven committees have been formed for the admission of objects in this section; and five of these committees are charged, moreover, with the task of arranging a preparatory exhibition, which is to take place in the Palais de l'Industrie, in the Champs Elysées, but will not be open to the public.

The whole of the expenses of arrangement will, in the case of this preparatory exhibition, be borne by the Imperial Commission. No articles will be admitted to this section of the French portion of the Universal Exhibition but such as have been previously received into the preliminary exhibition, but objects which, on account of their weight, size, or other circumstances, are difficult to transport, will be examined by the committee, or its delegates, at the producer's house.

Measures of this character tend greatly to produce that completeness for which the French exhibitions are already remarkable; and it is certainly the duty of every nation to consider how the most complete collection may be made in each of its sections and classes. From the very nature of some articles such preliminary exhibitions would be next to impossible, and comparatively useless, if practicable, while in others, the position of this country, amongst exhibiting nations, will depend in a great measure on the soundness of the preliminary steps that may be taken. There have been many admirable local exhibitions of late in England, and it is worth consideration whether the intervening time might not be well occupied by preliminary exhibitions of various kinds, for it is not the country that sends the largest amount of contributions, but that which sends the choicest and best arranged collection, which will make the best figure. A superabundance of objects diverts the attention from the most important amongst them; while a well-conceived and well executed plan sets everything off to the best possible advantage.

England has a year before her for preparation; her resources are immense, and she ought to make the most of the opportunity, and show the world in 1867 that her skill, science, and art have been advancing with her trade and commerce.

The Imperial Commission has adopted a different system for its working than that which has hitherto been employed on such occasions in France; the central administration only employs at present between twenty and thirty persons, and much, of the preliminary work at least, will be done by local and special committees. Ninety-five committees, or juries of admission, corresponding with the number of classes in the arrangement adopted, have been appointed to receive and consider the applications for space. These committees consist principally of men of science, artists and manufacturers, with whom a few officials and men of letters are associated, and they form together a body of four hundred persons well and honourably known to the public. In each department of the empire also a committee has been formed to aid the Imperial Commission with its local influence. These arrangements, together with the guarantee fund, give to the coming Exhibition more of a national character than its predecessors, and there is no doubt that the effect will be salutary.

There is another project spoken of which also indicates a tendency towards decentralization. It is said that it is not proposed to establish a general system of supplying motive power, but to make the motors themselves, with their appurtenances, a portion of the Exhibition. This has already been done, partially, at previous exhibitions; but the Imperial Commission contemplates its general application. The plan spoken of is to divide the machinery gallery into sixteen sections, and to entrust the supply of the necessary power to those who offer the most advantageous terms.

The Champ de Mars, where the building for the Exhibition is to be erected, is now being fenced in, and the drainage commenced. The outline plan of the building and its arrangements has appeared, and seems to meet with general approval. The building itself is to be of an obtuse ovoid form, the centre being occupied by a garden, and the various groups and sections of the Exhibition being ranged round in zones, the fine arts occupying the place next the central garden and the machinery the outer zone. Each country will occupy a space enclosed by radii of the oval, the distance between which will of course be regulated by the amount of contributions. The building will occupy only the central portion of the

Champ de Mars; the rest of the ground is to be planted as a park, enclosing the buildings for the exhibition of cattle, model cottages, and other things requiring much space. But the building itself will be brought into direct communication with the main roads which pass near it, and also with the river, by means of broad covered ways on the line of the main axis of the building, so that in case of bad weather the public will be under shelter from the extreme limits of the Exhibition. This will be a great convenience, especially to ladies, children, and invalids.

ON THE COMMERCIAL USE OF FLOWERS.

By EUGENE RIMMEL.

(Author of the "Book of Perfumes," &c.)

The following lecture, illustrated with practical experiments, was delivered before the Royal Horticultural Society on the 27th of July :—

Flowers are a source of pleasure and gratification to all, be they learned or ignorant; to many they offer particular attractions as an object of cultivation and study; for a few only they possess considerable importance as an article of commerce. It is on this point of view alone that I shall have the pleasure of addressing you to-day.

We are all led by a natural instinct to enjoy the pleasant odours diffused by fragrant flowers and plants. The humble floweret which blooms wild in the plain or on the mountain shares equally with its prouder sister which ornaments our garden the privilege of embalming the air, and of creating on our minds a cheerful impression. This charm, however, is of short duration; the flower soon fades and droops, the plant dries and sheds its leaves; and were not some means adopted to save their aromatic treasures in all their vitality and strength, we should be left, especially in northern climes, entirely deprived of "sweet smells" for many a long dreary month. To the art of perfumery we are indebted for this miracle, and for reviving in the middle of winter the enjoyments of the floral season; for, as Shakespeare says :—

> "Then were not Summer's distillation left,
> A liquid prisoner pent in walls of glass,
> Beauty's effect with beauty were bereft,
> Nor it, nor no remembrance what it was.
> But flowers distill'd though they with winter meet,
> Leese but their show; their substance still lives sweet."

The origin of perfumery, like that of all ancient arts, has been the subject of great controversy. Some assert it took its birth in Mesopotamia; others in Elam or ancient Persia, others again in Arabia; which has long enjoyed and still retains the name of the "land of perfumes." It is, however, certain that the first perfumes were obtained by a combustion of aromatic woods and gums (hence the name *per fumum*, "through smoke") and that the first use primitive nations made of them was to offer them on the altars erected to their gods, perhaps with the mystic idea that their prayers would reach them sooner wafted on the blue wreaths of smoke, or for the less poetical purpose of counteracting the smell of the flesh burned in their sacrifices. Modern incense derives its sweet balsamic smell from benzoin (*Styrax benzoin*), which also forms one of the chief ingredients in pastilles and fumigating papers.

The holy incense mentioned in the Exodus as having been prepared by Moses, consisted in equal parts of stacte, onycha, galbanum, and frankincense. Stacte is a kind of myrrh; onycha, a sort of shell found in the Red Sea; galbanum, an aromatic balsam; and frankincense, the gum of the *Boswellia thurifera.* I have here a table of all the perfumes known and used by the ancient Jews, amongst which you will find the celebrated spikenard, which Sir W. Jones has proved beyond a doubt to be the *Valeriana Jatamansi.*

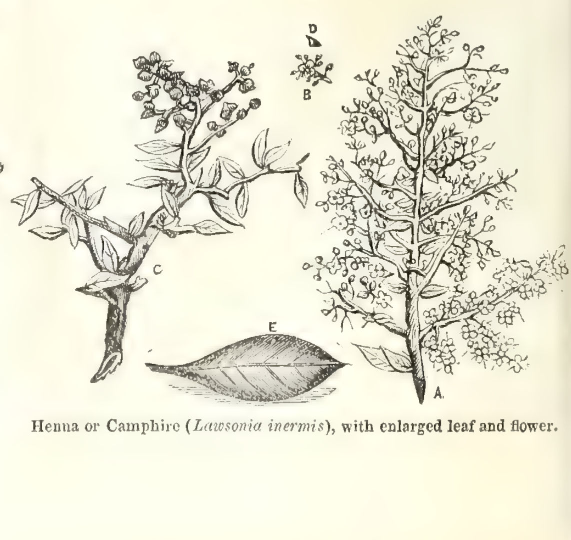
PERFUMES MENTIONED IN HOLY WRIT AS BEING KNOWN AND USED BY THE ANCIENT JEWS.

Aloes (*Aloexylum agallochum*).
Balm of Gilead (*Amyris gileadensis*).
Calamus (*Calamus aromaticus*).
Camphire or Henna (*Lawsonia inermis*).
Cassia (*Laurus cassia*).
Cinnamon (*Cinnamomum verum*).
Frankincense (*Boswellia thurifera*).
Galbanum (*Opoidia galbanifera*, or, perhaps, *Styrax Benzoin*).
Onycha (a shell) (*Onyx*).
Saffron (*Crocus sativus*).
Spikenard (*Valeriana Jatamansi*).
Stacte or Myrrh (*Balsamodendron myrrha*).

The first mention of perfumes made from flowers we find in Homer, who often speaks of rose oil, *ῥόδινον ἔλαιον*, which was probably obtained by infusing roses in oil. The Romans likewise used many perfumes, in the shape of oils, pastes, or powders, into which flowers and plants were incorporated.

Distillation is supposed to have been invented by Avicenna, an Arabian physician, who flourished in the 11th century, and who was the first to produce that deli-

Frankincense (*Boswelia thurifera*).



Henna or Camphire (*Lawsonia inermis*), with enlarged leaf and flower.

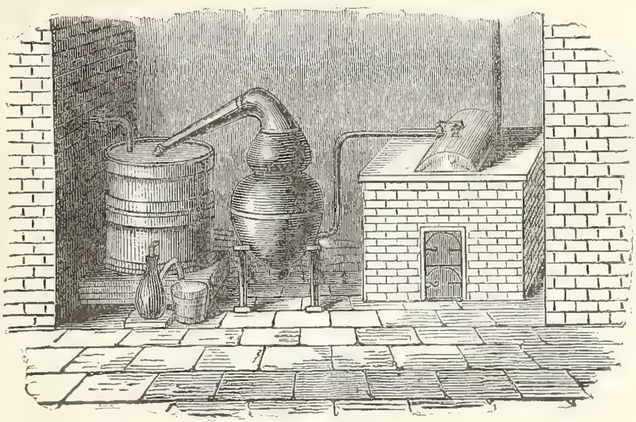
cious liquid called rose-water. I have here an Arabic manuscript of the 12th century, treating of medicine and perfumery, which at that time were combined in one, and containing, perhaps, the first illustration of a still, which was then of very rude construction.

Some centuries later, as Noorjehan Begum, the favourite wife of Jehan-Geer, was walking in her garden, through which ran a canal of rose water, she remarked a few icy particles floating on the surface; they were carefully gathered and found to possess an intense and delightful fragrance. This is given by Lieut.-Col. Polier as the origin of the far-famed otto of roses, which still sells in India for 60 rupees, or £6, per ounce.

Various ottoes or essential oils are now made in India from native fragrant flowers, principally at Ghazepore, on the banks of the Ganges. Besides the rose, they distil several sorts of jasmine, the pandang (*Pandanus odoratissimus*), the champac (*Michelia champaca*), the kurna (*Phœnix dactilifera*), the bookool or maulsarī (*Minusops elengi*), and the blossoms of the henna (*Lawsonia inermis*), the leaves of which are largely used by Eastern women for imparting a rosy tint to their fingers, the palms of their hands, and the soles of their feet. These essential oils are made in very primitive clay stills; the distillate is left to stand over night in open vessels, and the oil is skimmed off in the morning. They would be very beautiful if they were not spoiled by the admixture of sandal-wood shavings, which facilitated distillation, but give them all the same heavy flavour.

There are four means in use among modern European perfumers for extracting the aroma from fragrant substances: distillation, maceration, absorption, and expression.

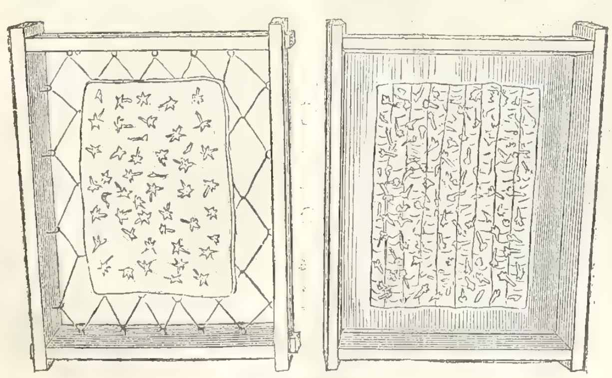
Distillation, which is applied to plants, seeds, barks, woods, and a few flowers, consists, as you all probably know, in placing the substance from which the scent is to be extracted in a copper vessel called a still, with enough water to cover it. Heat is applied, and the steam generated, which, impregnated with the fragrant molecules, passes through the head of the still into the worm, a coiled pipe placed in a tub, where it becomes condensed by means of the surrounding water, which is constantly kept cool, issues in liquid form at the tap, and flows into the recipient. If sufficiently loaded with aroma it then separates into two parts, the most concentrated of which, called the essential oil, collects either on the surface or at the bottom, according to its specific gravity. It is then decanted, and the water used again for distilling, unless it is of sufficient value in itself to be saved, as is the case with rose and orange flower-water. The recipient you see here is called a florentine recipient, from its having been first used at Florence, where flower distilleries still exist. It is constructed in such a way as to allow the water to escape whilst retaining the essential oil.



Steam Still.

A great improvement has been lately effected in distillation, which consists in suspending the fragrant substance on a sieve in the still, and causing a jet of steam to pass through. This operation produces a finer essential oil than by allowing the substances to be steeped in water, as it only carries off the most delicate part of the aroma without dissolving the bitter principles frequently residing in the basis.

The fragrant principles of all aromatic plants may be extracted by distillation, in the shape of essential oil; in fact, it exists ready formed in many of them, contained in minute vesicles, as you may see by bruising a thyme or rosemary



Oil and Pommade Frames.

leaf. Such is not the case with flowers; the aroma they possess, with a very few exceptions, is so fugitive that it would become destroyed in the process. In that case maceration or absorption is resorted to. Maceration consists in steeping flowers in a bath of hot grease, letting them infuse for some time, and renewing them until the grease is completely saturated. This grease, which is called *pommade*, is then submitted to strong pressure in horsehair bags. Oil is also perfumed in the same way, but requires less heat. This process is applied to rose, violet, cassie, jonquil, and orange flowers, but for more delicate flowers, such as jasmine and tuberose, the absorption, or *enfleurage* system, is employed. Purified grease is spread in a thin layer on a pane of glass mounted in a wooden frame or sash; fresh flowers are strewed over this grease, and renewed every morning; at the end of two or three weeks this grease or pommade acquires the scent of the flower in a high degree. Perfumed oil is made in the same way by substituting a wire bottom to the frame, and spreading on it a thick cotton cloth, steeped in the finest olive oil, which is pressed out of it after complete saturation. These frames are piled on each other to keep them well closed.

Monsieur Séméria, of Nice, lately devised an improved sort of frame for the *enfleurage* of jasmine. Instead of laying the flowers on the grease, he places them on a fine net mounted on a separate frame; this net is introduced between two glass frames, covered on each side with grease. The whole series of frames is enclosed in an air-tight recess, and all that is required is to draw out the nets every morning, and fill them with fresh flowers, which give their aroma to the two surfaces with which they are in contact. This saves the waste resulting from having to pick out the old flowers.

Mr. Piver, the eminent Parisian perfumer, has likewise invented a very ingenious pneumatic apparatus for making these pommades. It consists in a series of perforated plates, supporting flowers placed alternately with sheets of glass overlaid with grease, in a chamber through which a current of air is made to pass several times, until all the scent of the flowers is carried into the grease.

These two processes of maceration and absorption are founded on the affinity which fragrant molecules possess for greasy bodies, becoming fixed into them more readily than into any other. Thus the aroma of flowers is first transferred to these pommades, which are made afterwards to yield it to alcohol, whilst the latter, if placed in direct contact with the flowers, would not extract it from them. These alcoholic extracts form the basis of the finest perfumes, as they possess the true scent of the flower in all its freshness and delicacy. The best are made from pommades, those made from oil retaining a slightly oily flavour which is not agreeable.

M. Millon, an eminent French chemist, discovered another mode of extracting the aroma of flowers by placing them in a percolating apparatus and pouring over them sulphuret of carbon or ether. The liquid is then placed in a still, the sulphuret of carbon or ether evaporates, and leaves a dry waxy residue, which possesses the aroma of the flower in its most highly concentrated form. This process has not yet received a practical application owing to the expense attending it, as it requires an immense quantity of flowers to make a single ounce of these concrete essences. It is, however, very interesting, as an illustration of the absolute imponderability of perfumes, for although this substance appears at first sight to be the solidified principle of scent, if you treat it several times with alcohol it loses all its fragrance, but not an atom of its weight.

(*To be continued.*)

TECHNICAL TRAINING OF ARTISANS.

The following account of the Belgian Government Institution for the Technical Instruction of Artisans has been prepared by Mr. Oliver Le Neve Foster, from documents collected by Mr. T. Twining, in pursuance of the inquiry adverted to in the *Journal* for January 13th, 1865, p. 129:—

The Industrial Schools of Belgium are ten in number, namely—the Industrial School of Bruges, the Industrial School of Gand, the School of Arts and Trades at Tournay, the Training School of Soignies, the Industrial School of Liège, the School for Workmen at Verviers, the School for Industrial Drawing and Weaving at Verviers, and the Industrial Schools of Huy and Seraing. Amongst these Industrial Schools may be included the Higher Institution of Commerce of Antwerp, although it differs from them essentially.

With the exception of the Schools of Gand and Liège, these institutions are of recent date. The State in general has had some share in the expenses of their establishment. Although Government gave some aid every year to the expenses of these schools, yet it did not interfere at all in a direct manner in their management till 1859, and till then left to the communes the nearly exclusive guardianship of the high interests belonging to these establishments. But from that time they were reorganised completely by Government.

The instruction is free, except at Antwerp. Those only are admitted to the schools who are under a fixed age, and who have passed a preliminary examination, showing them to possess a certain general knowledge, such as is obtainable in the higher classes of elementary schools; but there are also evening classes for adults which serve, if needed, as preparatory schools.

Each establishment is under the direction of a managing committee. Its staff consists of a director, professors, and one or more inspectors named by the common council and approved by the Minister of the Interior. The committee fixes the hours of the classes, exercises a general supervision over the studies and discipline, and sends an annual report on the state of the school to the Minister of the Interior. The director is usually chosen from amongst the professors; he is entrusted with the superintendence of the studies and the carrying out of the regulations with regard to the teaching and discipline.

The Industrial School of Bruges (*l'Ecole Industrielle de Bruges*) was founded in 1853; it is annexed to the Academy of the Fine Arts, and is placed under the direction of the parochial Board. Its object is to initiate young artizans into that knowledge which in general is most indispensable for arts and trades. The instruction comprises elementary mathematics, mechanics, physics, and chemistry in its applications to manufactures and drawing. It is of an elementary and at the same time practical nature, and lasts about three years for the whole course.

The classes are so arranged that the pupils of both schools may follow them in common. The pupils of the Academy receive at the industrial school the theoretical lessons necessary for forming good workmen; at the Academy they receive the instruction in drawing which relates to industrial art.

The government of the school is in the hands of a committee composed of six members, two named by the parochial board, two by the existing deputies of the province, and two by the Minister of the Interior.

The Industrial School of Gand (*l'Ecole Industrielle de Gand*).—Under this name are united in one Institution the industrial school and the school for industrial designing and weaving of this town. The first of these establishments was founded previously to 1830, and was governed by a code of regulations, bearing the date of 27th November, 1833. The latter was instituted in 1852.

The new regulations decided on by the parochial board and approved of by the Minister of the Interior, bearing the date of 26th October, 1860, established the manner in which these two Institutions were to be governed.

The classes of the two Institutions were united and made to include elementary algebra and geometry, descriptive geometry, plan and ornamental drawing, the elements of physics and industrial mechanics, weaving,

the technology of textile fabrics, chemistry, and industrial economy.

The classes are conducted both in French and Flemish, and are extended over a period of four years. The classes are public and free, with the exception of those for drawing and weaving. The number is, on an average, 900, who follow one or more courses of lectures in different branches, but principally in industrial mechanics. It is worthy to be noticed that the majority of the professors at this school are former pupils of the classes. This circumstance is perhaps not without its influence on the practical results which this Institution has produced. These results are manifold. Thus, as to the pupils themselves, almost all of whom received their education at the free parochial school, they are now to be seen at the head of almost every industrial workshop, some as the owners, the majority as directors and foremen, and it is only by an exception, which is becoming rarer from day to day, that one meets anywhere a foreign foreman. As to the local industry, the results are not less striking.

THE SCHOOL OF ARTS AND TRADES OF TOURNAY (*l'Ecole d'Arts et Métiers de Tournay*) was opened in 1841, for the purpose of perfecting the manufactures of the town of Tournay, and for forming good foremen and workmen. Under the old organisation, the pupils paid annually the sum of £10 (250 fr.), for which they were boarded, lodged, clothed, received a certain elementary instruction, and were taught a trade.

By the decree of the 1st October, 1860, this establishment has been quite reorganised, and everything has been taken away from the new institution which was contrary to what it was really designed for, namely, to its being an establishment for the technical teaching of the working classes. Thus, the boarding-school has been suppressed, and in order to render the school perfectly industrial in character, public evening classes have been formed, which all workmen and apprentices are allowed to attend gratuitously.

The pupils receive technical instruction in the workshops.

Before the reorganisation took place there were four workshops in the school — the building workshop, the workshops for cap-making, copper-smiths' work, and weaving. The two latter have been discontinued, as they afforded no good results. By way of compensation for this, the workshop for cap-making has been notably developed and raised to perfection. At the same time the stock of tools for the workshops for building machines has been completed.

The theoretical instruction given at the school consists of arithmetic, elementary geometry, physics, chemistry and mechanics, and mechanical drawing. The budget of the school is as follows.—

A. Receipts.

1st. The subsidy of the commune.

2nd. The subsidy of the province and the state.

3rd. Its produce.

B. Expenses.

1st. The salaries.

2nd. The money necessary for the keeping in repair and the improvement of the apparatus for teaching, and the expenses of the distribution of the prizes.

3rd. The expenses of warming and lighting.

4th. Additional expenses.

THE INDUSTRIAL SCHOOL OF LIEGE (*l'Ecole Industrielle de Liége*) was first erected by some private individuals during the latter years of the union with Holland. It preserved the character of a private establishment till 1852, when the Commune of Liège, having recognised its utility, admitted it among the communal establishments, and determined to reorganise it, which was accordingly done in 1860.

The instruction comprises elementary mathematics and descriptive geometry in their applications to manufactures, physics, elementary and applied mechanics, chemistry, drawing (particularly that applied to manufactures), and hygiene. It is given by six professors, one of whom is the director. The classes are held every evening from seven to nine, and are gratuitous. There is likewise a preparatory section, the classes of which are also held in the evening, and a special class for stokers. The duration of the studies is three years. No pupil can be admitted who is less than fourteen years old, and who has not undergone satisfactorily a preliminary examination in reading, writing, grammar, arithmetic, and the elements of drawing. The number of pupils varies from two to three hundred. The new organisation which it has just received will probably add much to the advantages which the manufacturers of Liége derive from this establishment.

The budget of this school is of a similar nature to that of the last.

The remaining industrial schools of Belgium, which I have not noticed, are of a similar character to the above-mentioned ones; the subjects taught there are almost exactly the same, except, that at the school of Soignies the theory of stone-cutting and modelling is taught, and that at the school of Seraing the pupils learn, among other subjects, the working of coal mines.

Amongst the educational establishments for the improvement of the working classes, perhaps the most important are the apprentice workshops (*les ateliers d'apprentissage*), a good account of which is given by M. de Grave in his "Notice sur les Ateliers d'Apprentissage dans les Flandres."* He states that the principal employment of the working classes in Flanders was weaving by hand, but when machine weaving was introduced into England, a great part of the business of the Flemish weavers was taken away from them.

By a fatal coincidence, too, just at the moment when a trade which had seemed inherent in the soil of Flanders was being taken out of the hands of a quarter of a million of workmen, a potato famine and an epidemic of typhus fever added their horrors to the general distress. In order to furnish a mode of gaining a livelihood to the women spinners who had been thus deprived of all means of subsistence, there were instituted in nearly all the communes of Flanders, by means of pecuniary aid from Government, manufacturing schools, in which women and girls, under the superintendence of skilled mistresses, were taught embroidery, glove-making, sewing, knitting, and especially lace-making of all kinds. But it was not only spinning by hand that thus became lost to Flanders as a branch of industry, but also hand-weaving as then carried on. The weavers had never produced but one kind of work, as they had always been certain of being able to dispose of it advantageously. Their tools had remained the same for ages, and hence they were unable to struggle with success against the more perfect machinery, then introduced into Ireland.

This being the state of the case, it became necessary for Government to take measures for the protection of weaving.

In order to carry out the designs of Government the apprentice-workshops were introduced. The organisation and the carrying on of establishments of this class was necessarily economical. The branches of industry exercised there, were placed completely under the management of those masters (*industriels*) who were willing to undertake it. Government reserved itself solely the right of watching over these establishments and seeing the execution of contracts carried out.

The superintendence was exercised by the provincial inspector of workshops, and by a special committee appointed for each workshop, and composed as much as possible of persons of the neighbourhood acquainted with industry. In the contracts relating to these workshops, it was always expressly stipulated that the contractors

* Congrès International de Bienfaisance de Londres. Session de 1862. Tome I.

should give the persons who desired to devote themselves to such work every necessary help, should initiate them into the modes of working, and authorise them to imitate the machines and their products.

The necessary aid for this was furnished by the Government, the province, the communes, and the *bureaux de bienfaisance*.

The aid was not granted to place the contractor in a position to manufacture stuffs at a cheaper rate, but solely to indemnify him in case of those losses which every new enterprise entails.

The public intervention in the expenses of these workshops was, from the beginning, regarded as of a temporary nature. By degrees it was withdrawn, and at present there is not one workshop which receives aid from Government.

Besides these workshops of which we have just spoken, there were erected a considerable number of free apprentice workshops (*ateliers d'apprentissage libres*), that is to say, workshops in which the masters, without being bound by any engagement, furnish the thread, and pay a price agreed upon for the weaving; so that the preference is always given to the master whose conditions are most favourable to the apprentices. The greater part of these institutions are still in existence. They were erected in places where it was judged expedient, not to introduce new manufactures, but solely to make more general the use of a more perfect system of machines, to develope the aptitude of the working classes, and to facilitate the apprenticing of young workmen.

In 1860, an inquiry into the state of these workshops was made, in order to prove the propriety of their being continued or discontinued. After the question had been entered into at length in the Chamber of Deputies, the Minister of the Interior, M. Rogier, made the following statement:—"You have heard the evidence, and I think at present that no one can for a moment dream of the suppression of the apprentice workshops. Everywhere, in about eighty communes, and with but three or four exceptions, they are defended with inconceivable energy. All the communes entreat Government not to take away its benefiting hand, and state the great results which have been obtained by these institutions, for the complete suppression of mendicity and vagabondage, for the progress of morality and the welfare of the people; all, almost without exception, express this opinion in the most energetic terms, and myself, I avow it, I did not expect such a demonstration; I did not expect such a unanimous adherence; I scarcely believed that the institution of apprentice workshops could have produced such considerable benefits."

The apprentice workshops are established in buildings either constructed for this purpose by the communes or hired.

A machine for hand weaving, of as perfect a nature as possible, is placed there.

The direction is entrusted to an administrative committee, appointed, on the advice of the communal administration, by the governor of the province. Instructors are appointed by the governor of the province, for the purpose of teaching professionally the apprentices. It is necessary for every instructor to be able to read, write, calculate, and teach the apprentices all the practical and theoretical details of the branches of industry exercised in the workshop. The apprentices are instructed in everything that forms part of the art of the weaver.

A salary is granted to the apprentices, varying according to their ability and the stipulated conditions with the masters who furnish the workshop with work.

A deduction of between five and ten per cent. on the salary is made, and the amount of the deductions goes to furnish the apprentice with tools necessary for his trade, when he leaves the workshop. Elementary instruction for two hours a day is given to the apprentices.

Fine Arts.

Distribution of Works of Art in France.—In addition to the pictures and statues recently added to the collection of works by living artists in the gallery of the Luxembourg, the Minister of the Beaux Arts has just distributed an immense number of works amongst the museums and churches in the various departments of France, as well as in Algeria and the colonies. The number of local museums that have thus acquired additions to their art treasures amounts to more than a hundred, and one or more churches in almost every department have received donations.

Statue of Trajan.—It is said that a magnificent marble statue of the Emperor Trajan has been discovered during excavations made around the Villa Lavinia in Rome.

Exhibition at Bergen.—An artistic exhibition was opened at Bergen, Norway, on the 1st August. All the Norwegian artists have contributed, as well as many German, Danish, and Swedish painters. There are five hundred pictures in the exhibition.

Manufactures.

Working Men's Exhibition at Birmingham.—On Monday, the 28th August, there was inaugurated at Bingley Hall, Birmingham, a Working Men's Industrial Exhibition. The catalogue sets forth that there are 753 exhibitors, and the room required is 4,900 feet wall or hanging space, 3,820 feet floor space, and 3,830 feet table space. From the moment the project was mooted the artisans disposed to take part in it were warmly seconded by many of the principal manufacturers; to that circumstance no doubt much of the success attained may be attributed. The articles shown are of a very miscellaneous character. The staples of the local industry, of course, figure prominently. In stamping there are one or two wonderful specimens; of mechanism a great variety; of iron manufactures, furniture, saddlery, brass-foundry, jewellery, papier-maché, carving and gilding, there is a good display. The Rev. Dr. Miller, as chairman of the Exhibition Committee, presided at the opening, and there were present Lord Leigh, the lord lieutenant of the county, Lord Lyttelton, lord-lieutenant of Worcestershire, Archdeacon Sandford, Mr. Newdegate, M.P., Mr. D. Bromley, M.P., &c. The inaugural ceremonial was in part choral. A prize ode was performed, composed by Mr. Coombe Davies, the prize for it having been awarded by Lord Lyttelton. Thirty-two odes were sent in. The ode was set to music by Mr. Thomas Anderton. It was followed by the National Anthem. Lord Lyttelton then delivered an address, and the mayor declared the Exhibition open.

School for Watch Making.—Not long since, the French Government established a school at Cluses, in the department of the Haute Savoie, for the training of boys intended for watchmakers, with a view to the improvement of the methods employed in the trade. It was found, however, that the working classes in distant departments could not afford to send their children to the school, and pay their expenses there, and, it is said, the Minister of Commerce has instructed the prefects to lay the question before the *Conseils Généraux*, with the view to obtaining subventions in aid from the departments.

Ailanthus Timber.—In the article entitled "Hardy Silk Worms," in the *Journal* of the 18th of August, the wood of the ailanthus, or "Japan varnish tree," was spoken of as comparing favourably with that of the oak and elm. M. Raoulx, of Paris, has experimented on this wood during the last twenty-five or thirty years, and declares it to be actually superior either to oak or elm. The following is the average result arrived at by that gentleman after a great many experiments, all made under the same conditions:—

	Ailanthus.	Elm.	Oak.
Density......	0.713	0.604	0.751
Tenacity ...	32.812	24.867	19.473
Flexibility..	0.033	0.023	0.027

According to this statement, the ailanthus wood is more dense than elm though rather less so than oak; its tenacity exceeds that of elm by nearly a quarter, and of oak by full three-fifths; and it is nearly one quarter more flexible than oak, and one half more so than elm. These results are surprising when taken in connection with the fact that the tree is of very rapid growth, that the ailanthus seems to form an exception to the general rule, that the best timber is always the result of slow growth.

Commerce.

THE FRENCH SOAP TRADE, which is chiefly carried on at Marseilles, suffered considerably in 1864 from the import of pigs' fat, one of the ingredients it employs, having been much less from America than in preceding years, owing to the war, and to the import duty on olive oils from Italy being too high to permit the introduction of the article in the large quantities required, also to the duties on the oils from Genoa, Tunis, and the Levant being so arranged as to check importation. The production of soap consequently has declined, and although the population is constantly increasing, the consumption has been reduced also. In 1864, according to official returns, the amount exported was 480,025 kilogrammes less than in 1863. In the present year the falling off in exports has been greater, whilst the importation has increased.

IRISH BUTTER.—There has been a gradual diminution in the quantity of Irish butter sent to London. In the three years 1842 to 1844 it averaged 311,000 firkins per annum, while in the past three years it has not much exceeded half that quantity, though the number of milch cows in Ireland has nearly doubled. There is an increase in the quantity sent to Liverpool, but if the deliveries in the two ports are added together, it will not show a great increase. The arrivals in 1841 were 639,247 firkins; in 1861 they were 737,895; the increase is 98,648 firkins, worth about £350,000. The number of cattle in Ireland in 1841 was 1,863,116, valued at £12,110,000; in 1861 it had increased to 3,527,309, the estimated value of which was £21,172,508. The increased export of butter is equivalent to about 3½ per cent. on the capital invested, but this does not leave anything to pay rent for the ground devoted to this purpose, nor for labour.

CHINESE SUGAR.—Much extra ground has been set apart at Swatow this year for the cultivation of sugar, in consequence of the demand in the north of China for this product. The Chinese method of pressing sugar is most rude. The cane is passed between two perpendicular granite cylinders—one, being turned by oxen, gives a motion to the others by means of cogs cut in the granite, and shod with hardwood; the juice is thus expelled, and runs through a channel cut for that purpose into a large wooden tub, from which it is removed to the boiling hut closely adjoining. These cylinders are not at all firmly fixed, depending altogether upon their weight to keep them in position. A company of Europeans working a modern sugar mill might make a large profit, if the Chinese would consent to sell their crops when ready for cutting. An improved cane mill was imported by an English firm, but the natives refused to purchase or even try it.

Colonies.

FINANCIAL PROSPECTS OF QUEENSLAND.—It appears from the report of the Auditor-General on the public accounts of the past year that the deficit of £70,673, which existed at the close of the year 1863, was disposed of by being charged to the loan for immigration. The actual revenue for the year 1864 was £369,425, and the actual expenditure, including some old adjustment of accounts, £440,168, leaving a deficit approximating closely to that of the previous year, viz., £70,743. In addition to this, the revenue of 1865 is liable for the balances of votes already sanctioned by the legislature, but not yet expended, to the extent of £62,630. In land order transactions the aggregate issues for 1864 are stated to be £230,075, which have been satisfied to the extent of £133,031, leaving an outstanding liability on the 1st of January amounting to £97,026. The total liability, therefore, with which the treasurer has to deal in connection with the year 1864 is £230,399. The estimates for 1866 show an estimated revenue of £702,400, and an estimated expenditure of £670,586, the excess of receipts over payments being £31,814. These figures, however, include land order transactions. Considerable difference of opinion seems to prevail with respect to the propriety of reckoning land orders as revenue, a land order being simply an acknowledgment that the holder of it is entitled to a free grant of land. The steerage passenger gets eighteen acres and the cabin passenger thirty acres of land, but neither the one nor the other contribute either £18 or £30 to the revenue. When a selection is made the land order is cancelled, but the land so alienated is not sold, and the nominal value of it has no right to appear in the proceeds of land sales. The colony gains indirectly in exchange for its free grants of land, but it does not appear that the revenue is entitled to take credit for an immigrant's person any more than for his capital, or any other effects he may have brought with him.

THE FIRST QUEENSLAND SOLICITOR.—A Queensland journal records the fact that Mr. W. Fowles has been admitted as an attorney and solicitor to practice in the Supreme Court of Queensland—the first practitioner whose legal education has been entirely derived within the boundaries of that colony.

CINCHONA.—A writer in the *Queensland Guardian* says that the cinchona plant is indigenous in that colony. "It grows plentifully at Gayndah, and very abundantly in the Burnett district. I have seen it on the banks of the Mary river, as well as in the interior of the Wide Bay country. Visitors to Sandgate can either eat the leaves, pluck the berries, or drink the juice of the bark, which they can chip from the trees overhanging the sea. I have seen, and have now in my possession, a very excellent tincture, a homœpathic preparation, prepared by a professional gentleman in this city, which, if I have any occasion to use, I should be willing to try it on illness requiring quinine."

NEW TARIFF IN VICTORIA.—The following is a statement showing the amount of duty collected (under the old tariff) during the months of February, March, and April, 1864, as compared with the collections (under the new tariff) for the same three months of 1865, and with the amount that would have been collected on the same goods under the old tariff:—

	1864. Actual Receipts.	1865. Actual Receipts.	1865, if old tariff had been in force.
Customs	£273,940	£308,314	£302,074
Gold	26,574	17,684	26,526
	£300,514	£325,988	£328,600

Publications Issued.

TRAITÉ SOMMAIRE D'ÉCONOMIE POLITIQUE. By M. J. G. Courcelles Seneuil. (*Guillaumin and Co.*, Paris.)—A short popular treatise on political economy, by an author who has made himself a name in France by his larger works on banking, political economy, industry, and social science. The increase in the number of works of this

nature marks a decided change in the habits of thought of the French people, whose attention has of late been greatly given to economical questions, whereas ten or fifteen years ago the great mass of the population had scarcely an idea that political economy was a matter in which any but the governing classes could have an interest. M. Seneuil's work is concise without being meagre, and treats of all the great questions of political economy and its applications, in less than three hundred pages, with that logical simplicity which is one of the happy gifts of French writers. English economists will be interested in the work from the fact that the subject with which they are familiar is treated from another point of view and under circumstances differing in many respects from those which prevail in our own country.

Notes.

Instruction in Horticulture has been included in the normal primary school of Chartres since 1840, and forms one of its most important classes. The gardens of the school cover two hectares, or about five acres, of ground, and are appropriated in the following manner:—39 *ares* to arboriculture, 58 to the kitchen garden, 62 to wood, 20 to botany and ornamental gardening, and 20 *ares* for fish ponds. The director is a horticulturist of repute, and his assistants have all been pupils in the school. Professors attached to the model farms belonging to the Government, as at Grignon, and a few amateurs of the neighbourhood, give lectures and hold conversations at intervals. A series of meteorological instruments exist in the establishment, and daily observations are made respecting temperature, moisture, and force of the wind, and are registered with scrupulous attention. The gardens are a source of great interest to the agriculturists and amateurs of the department, and the directors have obtained a large number of medals and other awards, not only at Chartres, but also at Dreux, Châteaudun, Caen, and other places.

Mummies in Guano.—The Museum at Havre possesses several specimens of animals preserved in the guano of the Chincha islands, but much greater interest has been created by the exhibition of a human mummy found embedded in the same kind of deposit on the coast of Africa, than by all the former acquisitions of that kind in the museum. The body is in a complete state of preservation, and appears to be that of a man of Caucasian race. M. Leunier, the curator of the Museum, has carefully examined the mummies under his charge, and reports that they all exhibit, under the magnifying glass, crystals of ammoniacal salts, to which substances the preservation of the bodies is principally, if not entirely, attributed.

French Coast Telegraphic System.—Within the last few years the oceanic coasts of France have been brought into communication, by means of the electric telegraph, with the head-quarters of the four maritime commands established in that portion of the empire; the stations on the coast are also supplied with semaphores, which enable vessels to communicate by means of signals, so that the Minister of Marine is in fact in direct communication, not only with the coast, but with every vessel within signal range. These semaphores are also open to the public, so that the captain of any vessel, inward or outward bound, may send or receive news direct to or from any part of the country. In order to complete the system, however, it will require eighteen submarine cables to be laid down between the mainland and the islands dotted about the coast, and the laying of these is about to be commenced by the vessel especially devoted to that purpose by the Imperial Government, the *Dix Decembre*, which has returned from laying the Algerian cable. Amongst the coast cables to be laid immediately is that which is to unite the Isle of Ushant with the main land.

Scientific Congress at Spezia.—The Italian Society of Natural Science announces that its second extraordinary congress is appointed to take place at Spezia, on the 17th and three following days of September, under the presidency of Professor G. Capellini. The *savants* of all countries are invited to attend, and those who will take the trouble to write previously to the president will be provided with lodgings by the municipal authorities of the place. The neighbourhood of Spezia is peculiarly interesting to the naturalist, and it is expected that the meeting will be numerous and animated.

Patents.

From Commissioners of Patents Journal, August 25th.

Grants of Provisional Protection.

Anti-inflammable starch—1946—T. Pepper.
Candle-manufacture—2085—J. H. Johnson.
Crinolines—1922—J. Leetch.
Eyelet-making machines—2079—W. E. Newton.
Fibrous materials, apparatus for treating—1952—H. Sherwood.
Furnaces—2105—J. F. Boetius.
Gas, carburetting—2095—H. Woodward.
Holders or files for holding letters or music—2097—F. Brampton.
Jewellery, articles of—2103—R. C. Lilly and J. Sunderland.
Knives, apparatus for cutting scales of—1988—W. Singleton.
Lawn mowing machines—2119—J. B. Brown.
Liquids, apparatus for ejecting and spreading—1044—G. A. Montenat.
Looms—2073—J. and H. Ingham and J. Broadley.
Looms—2091—W. Bullough.
Looms—2115—W. Gadd and J. Moore.
Metal pins—1920—H. W. Hart.
Microscopes and telescopes, mounting—2075—C. J. R. Jahns.
Photograpy on copper—1984—F. R. Wells.
Railway chairs—2099—W. F. Henson.
Safes, &c. (fireproof) fixing—2081—P. C. Kjellberg.
Table-salt, manufacture of—2087—H. Jee.
Ventilators—2111—J. Billings.
Wool, cotton, &c.—2089—J. Tatham and J. Smith.
Yarns, &c., machinery for bleaching and dyeing—2113—J. Smith and W. Schofield.

Inventions with Complete Specifications Filed.

Lucifer matches—2153—G. C. Dennis.
Steam engines—2130—J. Stevenson.

Patents Sealed.

547. C. Ching.	579. A. T. Godfrey.
553. J. Blackie.	585. S. Chatwood.
558. G. Lauder.	592. R. Johnson.
560. A. Davy.	602. L. Thomas.
560. W. B. Dalston.	638. W. Clark.
566. J. Hartshorn and W. Redgate.	639. W. Clark.
567. S. Whiting.	659. W. Clark.
572. G. H. Barth.	1019. R. Fergusson & W. Ralston.
573. W. Holiday.	1494. H. Monier.

From Commissioners of Patents Journal, August 29th.

Patents Sealed.

577. J. Dodd.	636. L. Perkins.
578. W. E. Kochs.	642. F. Tolhausen.
580. T. Horton and D. S. Price.	665. W. D. Allen.
589. P. Rothwell.	668. G. F. Ansell.
591. C. Rahn.	670. J., E. G., and C. H. Freeman.
597. D. and J. Manwell.	687. J. Garelly.
599. R. A. Brooman.	718. L. Gantert.
610. L. Le Chev. Cottam.	943. C. D. Young.
611. R. A. Brooman.	1104. D. Greig.
612. W. Clulow.	1325. G. and G. W. Simmons.
622. S. and W. Smith.	1392. W. E. Newton.
637. A. E. A. Aubert and G. E. M. Gerard.	1623. G. E. Way.

Patents on which the Stamp Duty of £50 has been Paid.

2347. R. Harrington.	2410. J. H. Johnson.
2465. J. H. Johnson.	2411. J. Meyer.
2467. W. A. Richards.	2511. A. E. H. B. Butler.
2374. R. Sims.	2370. A. Crichton.
2391. W. Husband.	2379. R. A. Brooman.

Patent on which the Stamp Duty of £100 has been Paid.

1959. J. Ireland

THE

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AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, SEPTEMBER 8, 1865. [No. 668. Vol. XIII.

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Announcements by the Council.

EXAMINATIONS FOR 1866.

The Programme of Examinations for 1866 is now published, and may be had gratis, on application to the Secretary. A copy has been forwarded to each Institution and Local Board.

Proceedings of the Society.

MUSICAL EDUCATION COMMITTEE.

The Committee met on the 12th June. Present—Henry Cole, Esq., C.B., in the Chair; Lord Gerald Fitzgerald, the Right Hon. Sir George Clerk, Bart., Sir John Harington, Bart., Sir J. P. Boileau, Bart., Colonel Scott, R.E., Captain Donnelly, R.E., Mr. R. K. Bowley and Mr. R. Puttick.

Henry F. Chorley, Esq., examined by the Committee, as follows:—

316. You have had considerable experience with the subject of education generally, and musical education in particular?—Some experience.

317.—Have you formed any opinions with regard to musical education in this country?—I have.

318. Should you think it right or expedient to attempt, according to the usual practice in this country, to reform an old institution or to create a new one in the case of the Royal Academy of Music?—I am speaking at a moment's warning, because I have not lately thought the matter over, especially in reference to this committee; but most assuredly I would rather the establishment should be built anew from top to bottom, than that it should be repatched, leaving any part of the present fabric untouched.

319. Instead of a reform you would prefer a revolution as regards the Royal Academy of Music?—I should. I have considerable hesitation in expressing my opinions on the subject; as they may give pain to many persons whom I highly esteem and respect as individuals.

320. You consider it would give less pain to individuals to establish the thing anew than to attempt to lead those at present connected with it into a better course if possible?—I do. My own opinion is that it was a mistake on the part of Parliament to accord a grant to the Academy without hearing evidence before a committee. The grant was made in compliance with a petition. We all know that any cause can get any amount of signatures calculated as serviceable. Some sign from intimidation; some from imitation; others in mere thoughtlessness.

321. But this committee finds itself in this position. Here is a Royal Academy of Music, with the Crown at its head, with the patronage of many distinguished personages, though perhaps it does not hold the position in musical eyes which it might: Parliament, in its wisdom, or, as you may think otherwise, has thought it right to endow it with a grant, and the institution exists under the protection of a Royal Charter. Looking at all these circumstances, the committee have to deal with an institution already in existence rather than with any new plan of its own.—Assuredly.

322.—It is also a proper and moot point for consideration whether it would be better to try and improve the existing institution or attempt to establish a new one. We understand your opinion to be in favour of beginning *de novo*?—Certainly, it is so.

323. Have you at all considered the difficulties that would probably attend the formation of a new institution of this kind?—I have considered too many of the evils that have attended the old one.

324. I collect from the paper which you were so good as to read before the Society of Arts, you think that the State ought to recognise a Conservatoire or Musical Academy?—I do.

325. That being so, do you think that Parliament would be likely to give recognition or endowment to two institutions of the kind?—I think if there had been, what I humbly ventured to suggest at the time, such a hearing of evidence as was called for in the case of the question of dramatic monopoly, and has more than once been accorded to the art of Painting, the insufficiency of the Royal Academy would have been proved so strongly that that grant never would have been given.

326. But the grant having been given, the question is if it would be easy to get a second grant for the more perfect institution you contemplate?—in your opinion, would it be safe to attempt that?—You ask me a question that I cannot answer at a moment's warning.

327. Is it not in your opinion possible to renovate the present institution so as to make it tantamount to a new institution?—I think it would be difficult to do so—to the edge of impossibility. Let me repeat that when I have to speak on this subject I feel placed in a delicate

position, as I must give pain to people whom personally I regard very highly.

328. Then we would ask you to give us the benefit of your own theory with regard to what you would consider a better institution?—I must do this by illustration. I think there are radical defects everywhere, mistakes from first to last, in the constitution of the Royal Academy of Music; and I will tell you as well as I can, though disconnectedly, what I think they are. To give one instance, I think it is a vital defect that the presidence of the Academy is so slack, in place of the school being overlooked by a resident superintendent, with no other business than to attend to the concerns of the institution.

329. You do not think it impossible to have a resident superintendent of the Academy?—Assuredly not. It ought to be an established thing that there should be a functionary wholly devoted to such duties.

330. As the principal or head of the establishment?—Perhaps, or merely as a general superintendent; a person to see that the lessons are properly given, and that the whole discipline is properly administered. Then, I think the course of study is a mistaken one. I think it is a mistake that a person who wishes to learn the violin, for instance, should be required to learn other branches of art also. For here is the second clause as stated in the constitution of the Academy:—"All branches of music are taught in the Academy: should the particular branches for which the students enter be harmony, singing, or pianoforte, the male students will be required to learn in addition *any orchestral instrument the committee may require*. I infer from this that a pupil may be required to do a little of everything, and therefore is likely to do nothing good in any special department.

331. You think the system you have described leads to mediocrity?—It has been so proved by the results. Where, to offer a striking example, has any leading female singer come of late from the Academy who is capable of singing Handel's songs so as to take a leading part in oratorios?

332. Admitting the force of your objections, do you think the system irremediable in the Academy?—I think it must be reconstituted entirely.

333. You think it is capable of reform?—Not as the present constitution of the Academy stands.—Then there is a regulation, No. 8, which says, "Advanced students will be required to give instruction in the Academy."—I have a list before me of the professors of the Academy. —There are three in Composition and Harmony of whom the world has never heard anything at all. Here are also six in the singing class that I happen to know have never sung in public at all; some of them are at the present time taking lessons in order to qualify themselves for singing at concerts.

334. And yet they are allowed to teach at the Academy?—There is a strong case I could refer to—the case of a professor in the classes for singing for whom I have the greatest personal and professional regard, and to whom I have sent many private pupils. He has been absent from the Academy the whole winter, and his singing class has been handed over to a deputy. In the pianoforte class I find four or five names whom nobody ever heard of before as pianoforte players; and so throughout the whole list of professors. It would seem that you cannot pay the professors well enough to make them attend to their duties, and hence these are entrusted to incompetent deputies. We see what is the result. An immense disheartening amount of mediocrity. There has not been one commanding English artist, vocal or instrumental, turned out of the Academy during the last twenty-five years; as I, who have to give an account of London music from week to week, feel very vexatiously. For our oratorios, for instance, we must have resort to Mesdames Parepa and Sherrington.

335. They are English ladies are they not?—But not educated in this country. Madame Sherrington was educated in the Conservatoire of Brussels. The last and best English singer from the Academy who has made any high reputation is Madame Sainton Dolby. We have had no other female singers, that I recollect, who are capable of taking a leading part in Handel's music. Our great English soprano, Madame Novello, was educated in York. Mr. Sims Reeves, Mr. Santley, and Mr. Weiss were trained elsewhere.

336. You attribute much of this shortcoming to the constitution of the Academy; will you favour the committee with your views of what the constitution should be?—That is like asking me to frame a new one of my own; this I am not arrogant enough to do on so short a notice. I think in the first place that its principal ought not to be connected with any business.

338. With submission, that hardly refers to the constitution?—I think it does, since it is not provided against. I doubt whether any Committee made up conjointly of amateurs and professional men can ever arrive at anything near to what is good, because on the one side there are all manner of private interests and influences, and on the other side all manner of old traditions.

339. You think there should not be a mixture of amateurs and professionals on the committee?—The smaller the committee the better.—I think the *Conservatoire* of Paris was brought to its present state by the appointment, under the Empire, of Cherubini as its head, with ample power.

340. You think the appointment of a despotic superintendent preferable to the existing constitution of the Royal Academy of Music?—I do.

341. Do you think there should be a committee of management at all?—Yes, for details, but not for perpetual interference.

342. Does your notion of a superintendent go to investing him with powers over the professors?—No; but I think my notion would be that there should be a body of professors appointed; and that once appointed they should not be at liberty to perform their duties by deputy; and that it should be the business of the superintendent to see this regulation not broken.

343. Would you put into the hands of the professors what is called the lay management of the Academy—the looking after the expenditure, the cleaning, and the moral conduct of the students?—I should think the superintendent ought to undertake those duties.

344. Would you have the superintendent appointed by the professors?—No; by the people who find the money for the support of the institution.

345. Supposing the public do, as at present, find the money, do you not think they would require to be represented in some way in the expenditure of it?—I think if a good result was shown after the second or third year, the public would not demur or interfere so as to damage. Inquiry from time to time there will always, and should be. The best answer to this is result.

346. We may collect, from the opinions you have expressed, that you think the institution ought to be aided by the State. Do you think the State should be the whole paymaster, or would you have contributions from the public besides?—I think the whole matter could be presented to the State on some such representation as this. You have to look at the fact of the number of persons who go abroad for their musical education. A young girl (for instance) cannot go to a foreign Conservatoire without her mother or some relative accompanies her. This would be rendered unnecessary, were our home education in the least satisfactory. I think the institution ought to be in part self-supporting.

347. By the fees of the students?—In part by the fees of the students; but based on such a public grant as would secure such good teachers in the Academy as to make it impossible for their duties to be performed by deputy, without making the fees too onerous.

348. And pay them adequately?—Assuredly.

349. Who is to pay them?—I have mentioned a Government grant. There is one now.

350. Would you have the Government undertake the whole pecuniary responsibility?—No; nor do I believe it would undertake it.

351. You would wish the responsibility of the management to be undertaken by the House of Commons?—So far as the Government grant goes, yes. It might fairly, I think, proceed on report.

352. You think that would be more effectual than the present system?—I think there is no very great public displeasure with regard to the present President of the Royal Academy of Arts. There should be a person in a similar position with regard to the Royal Academy of Music. I feel that by dividing and sub-dividing, and having amateurs and professionals too largely mixed up together, both time, money, and progress are frittered away.

353. Is it your opinion that the first grant of £500 was received with such acclamation by the House as to lead you to think it could easily be increased to £5,000?—I know nothing about that.

354. Does it not seem to you the first point should be to "first catch the hare"—*i.e.* the money? If you could get the State to pay the whole expense your theory might be very satisfactory?—I do not see that anything in England wants support that is thoroughly well done. We fling away what would be fortune and opulence to many a worthy institution on waste, experiments, and private favouritism. I am indisposed to go on patching up the old thing year after year.

355. The committee would be very glad to receive your plan for the remodelling of the Academy?—I have said that I am not prepared with it at this moment.

356. You would have no objection, after reflection, to furnish the committee with it in writing?—Perhaps not, if I have time. It will require time.

357. You attribute part of the failure of the Academy as to the results to defects in the constitution. Do you attribute any portion of the failure to incompetency on the part of the professors; to the mode of teaching, or want of ability on the part of those who are taught?—I repeat that one cardinal fault in the constitution is that which allows the professors to evade their duty. There is no doubt that the principal professors are in general well selected; but it appears they are so inadequately paid that they are tempted to wander away and allow persons who are taking lessons to teach their pupils; and I would not allow any professor to absent himself from the Academy without formal permission on sufficient grounds.

358. If they are not sufficiently paid must they not necessarily go away from the Academy?—It comes to that, no doubt.

359. How would you get the money to pay them adequately, and prevent their leaving?—I repeat my belief, that if you had a really sound institution to begin with you would have no difficulty in getting the money from sources partly public and partly private.

360. With such an institution as you would sketch out calmly, do you think the money might be obtained to carry it out?—I do not believe the want of money would be any difficulty, because I see perpetually in my intercourse with the musical and amateur world, and have seen, how magnificently students going abroad to get their musical education, because they cannot obtain it here, have been assisted. We ought to have the best musical education in the world. With all the variety of professors of the first class resident here, we ought to give a thoroughly good and cheap musical education in this country.

361. The committee would be glad to receive your ideas of a system which should obviate the necessity of people going abroad to get their musical education; and they would be glad to know if that could best be done by uniting that which was good abroad with that which exists here. Assuming that by some mode or other sufficient funds are obtainable to give a good musical education in this country, I would proceed to ask you in detail upon some of the points in your paper before the Society of Arts. I gather that you would like to have the endowment for scholarships?—I do not see why this should not be. If pupils have turned out well, I do not see why they should not have the benefit of travelling for a couple of years. A composer or violinist might go to Germany, a singer might go to France or Italy.

362. Are you in favour of students paying fees?—Assuredly.

363. Probably graduated fees?—That would be best, I think.

364. And students of rare ability paying no fees at all?—Surely so, when justified by examination and circumstance.

365. Going a step farther than that—supporting them also?—I don't know. That is a delicate question.

366. If a benevolent musical man thought proper to bequeath £1000 to the Academy to endow a scholarship, you would see no objection to the institution accepting it?—Certainly not. On the contrary, that is the basis on which many institutions have been raised and extended.

367. Are you aware that at Leipsic the endowments are small, and that the chief support of the academy there is derived from the fees of the students?—And why should it be that English students should have to go to Leipsic for what they cannot get so well at home?

368. You would wish to see a good library in connection with the Royal Academy?—I would. To return for a moment: we were discussing the other day what should be done with a new Mendelssohn scholar, and it was decided that he should be sent to Leipsic. In our Royal Academy of Music there is no professor of the German language, nor of French, and people who have to prepare themselves to sing in these languages must go either to France or Germany. I would have such an education in a central academy of the leading metropolis of the world, as to enable the pupils to sing in the foreign languages most required in music, especially Italian. I think the pupils ought to have access to professors who could teach them properly to pronounce in the three languages in which they would have to sing, and not least of all in their own. I could name compositions by professors at present attached to the Academy, which make it obvious that they comprehend neither the poetry nor the prosody of their own language. I would have no such person sing, or teach singing, or instruct in composition.

369. The reforms or improvements at which you glance would, of, course, entail a largely-increased expenditure?—If there was a good grant to a really good thing I don't believe it would be grudged by the public.

370. What would you call a good grant?—You ask me to reconstitute the Academy, and state what the professors should have for certain duties.

371. Supposing you, as a person devoted to music, went to Parliament, you would go with a definite demand?—I cannot answer you at the moment.

372. Perhaps you will give us your ideas on the subject hereafter?—I may say I think there ought to be something like £10,000 a-year voted by Parliament for music, considering the place and progress of that art in this country; and I think for that sum it could be done most completely and perfectly.

373. Would you make the payment of the whole or part of that sum conditional on the work done, or would you pay the whole sum in faith?—I would pay it in faith, perhaps. When we see how much painting, including design, has received in aid, if one art is aided by money the other ought to be aided also.

374. For how long a time would you say should the money be paid in faith?—That I cannot say; I am not ready with a working plan.

375. What should you consider would be a fair period for the experiment, three, five, or ten years?—I would

rather have the money paid a couple of years beforehand, so as to get the new Academy well organised and arranged, and not started as a scheme rushed into in a hurry.

376. Supposing you failed in making Parliament as enthusiastic as yourself on this subject, would you abandon all efforts to improve the existing institution?—I have a great notion that what was said during the discussion upon my paper here is true, that it is no use to mend an old coat.

377. Assuming a new coat is to be made, one question is, if you would call upon Parliament to be the only tailor?—No; I presume the students would put the buttons on, and the public help at the lining.

378. Would you put the entire responsibility of the expenditure upon Parliament?—I have said not; but I would have Parliament grant a liberal vote.

379. Do you assume, with the present grant of £500, and with a less grant than £10,000, all efforts to improve the present Academy should be abandoned?—I see no chance of improvement without demolition. I think if there is to be a government establishment for the advancement of a great art, it ought not to be done in a peddling twopenny-halfpenny way. I know that many private individuals are ready and anxious to give their aid, without personal interest or desire for notoriety. Meanwhile I am frequently asked, with regard to persons who have good voices and good musical talents, "Where shall we send them?" Certainly not to the Royal Academy. I would rather bide my time and send them abroad, than say a word to aid in patching up the old system.

380. Taking the condition of the Royal Academy of Music to be at present at zero, do you consider it to be quite incapable of resuscitation under its present constitution?—I repeat it would be a very difficult thing to do—verging on impossibility.

381. You think, with an income of £10,000 a year, such an institution as you would approve of must be efficiently supported?—Yes, certainly.

382. In the event of Parliament refusing such a grant as you would consider proper, would you still supplement the resources of the Academy by public subscriptions and the fees of the students?—Certainly; I do not think it would be a good thing to make an establishment of pauper scholars.

383. You would supplement the present or any moderately increased government grant by the subscriptions of the public?—Certainly.

384. We gather that your objections to the present constitution of the Academy are, first, the want of a resident superintendent? In your opinion, should the superintendent necessarily be a professional musical man, or merely a person of good general and business qualifications?—He should be a person who had nothing else to do but to superintend the proceedings of the Academy.

385. Should he necessarily be a member of the musical profession?—That is a question I am not prepared to answer.

386. You think it is not strictly essential?—Not necessarily so, but he should be a person whose interest and desire it would be that the whole duties of the Academy were regularly and properly performed.

387. Are you aware that up to a recent period there has been a resident superintendent of the Academy fulfilling the duties you have indicated?—Yes.

388. Then in theory the system was right, though practically it did not work well?—I think the person at the head of such an establishment should be a shrewd, clever man. The theory can hardly be put in practice under the existing constitution.

389.—Your next objection to the present system we understand to be that the students are required to learn other branches of music than that to which they wish specially to devote themselves?—They are required to do too much.

390.—Do you think it a disadvantage to a singer that he should be able to play the pianoforte?—Oh, no.

391. Or that he should understand the principles of harmony?—Certainly not. But if a pupil enters for the violin, I do not see the advantage of his being compelled to learn the pianoforte or the bassoon to eke out the orchestra.

(Sir George Clerk: He is not obliged to learn the pianoforte; the converse is the case.

Mr. Chorley: He must learn whatever orchestral instrument is wanted to fill up the band. Quotes Regulation No. 2.)

392. Do you think it a disadvantage to a singer to be able to accompany himself on the pianoforte?—I have said certainly not; but I do not think it should be made obligatory upon the students beyond a limited point. Some of the best singers in the world are not able to play at all. Pasta was a great singer, yet I never heard of her accompanying herself.

393. The next point you mentioned was, that advanced students are required, if capable, to give instruction?—I have an objection to instruction by deputy, and by pupil teachers entirely, for this reason, that for young pupils the best and most experienced masters are wanted.

394. Are you aware that the pupil-teachers only give instruction in what is called the second branches of study?—I think that should be the work of the professors.

395. Have you examined the whole system of the Academy in detail?—Yes; by having closely watched and tested the results; and I would not allow a pupil belonging to me to remain there a month if he were not under the principal professors.

396. Were you ever inside the Academy?—A good deal in former years.

397. Not lately?—No.

398. Are you aware whether any changes and improvements have taken place since you were there?—I see no proof of the latter. I have been at three or four of the concerts, and they are less satisfactory than they were twenty-five years ago. And this brings me to another point: I cannot think that the pupils at the Academy should be allowed to tire their voices by singing elsewhere.

399. You think they prematurely bring themselves forward?—Certainly; since I perceive they are allowed to perform at concerts elsewhere. My notion of carrying on the Academy would be that the pupils should not be allowed to take engagements on their own behalf, or go about performing till they were accredited as ripe. While I would make the professors more easy and comfortable, I would make the students' discipline more stringent.

400. With the £10,000 you think the practice and discipline of the Academy could be made as strict and as efficient as you could desire?—I think if the suggested principle were worked out you would arrive at something near it; but, so far as I can understand, there is no discipline at all, and every pupil can get permission to go where he likes.

401. Are you aware, with regard to the instrumental pupils, that a great number of them are employed in the opera and Philharmonic orchestras?—No doubt; but I cannot remember one great instrumental player the Academy has turned out during the last 25 years. I should like to know one.

402. Are there any other objections beyond those you have stated to the system in the Royal Academy?—I think the first thing is the want of a resident superintendent; the second, the teaching by deputy; and the third, allowing the pupils to take engagements while they are students and before their education is finished.

403. In whom would you rest the appointment of the superintendent? With the duties you would assign it would be a position of great responsibility.—Assuredly, and a very difficult one.

404. But there must be a governing body of the Academy of some sort. What in your opinion should be the action of the governing body? Should the government be in one person or in a committee?—A small committee consisting of as few members as possible.

405. About the same number as there are trustees of the National Gallery?—Something of that kind, perhaps; as limited as possible.

406. Would you consider it beyond human power to obtain a new charter for the Academy?—There is no telling what human power could do.

407. You would not object to the title of "Royal Academy of Music?"—Surely not.

408. Is it your opinion that there should be a head and responsible professor in each department? Do you think, for instance, there should be a head singing master?—I think that the professors should be responsible for their pupils till their education is finished; and that when the pupils go to receive their lessons they ought always to find the professors who undertake to teach them there, and that no change from caprice should be allowed on one side or the other.—I think the pupils should not be allowed to evade lessons by taking engagements elsewhere.—I think there should be perfect order and system in the instruction, and the lessons should be given with the greatest regularity; and there should be a person in general authority resident in the Academy to whom appeal could be made both by professors and students.

I cannot permit this revised report of my evidence to go out to the public without respectfully stating that I met the committee without the slightest idea of being put under examination, and that while I have not altered or modified a single opinion which I felt it my duty to offer, on the spur of the moment—merely confining myself to the correction and removal of verbiage, and to an addition or two made for the sake of distinctness—I feel the incompleteness of my testimony on many points which I consider of importance.

HENRY F. CHORLEY.

Full opportunity will be afforded to Mr. Chorley to complete his testimony.

P. LE NEVE FOSTER.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BIRMINGHAM, 1865.

The thirty-fifth meeting of the British Association commenced on Wednesday, the 6th instant, under the presidency of John Phillips, M.A., F.R.S., Professor of Geology in the University of Oxford.

A meeting of the General Committee was held at one o'clock, Sir Charles Lyell (the retiring President) in the chair. The financial report showed that the receipts of the Association for the past year were £3,831, and that there was an available balance of £759 in the treasurer's hands. A long discussion took place on a motion made by Dr. Hunt, and seconded by Sir Edward Belcher, to the effect that a separate section be formed, to be devoted to the Science of Anthropology. The motion was ultimately negatived.

At the general meeting in the evening the President delivered the opening address, of which the following are some of the most interesting portions:—

"Assembled for the third time in this busy centre of industrious England, amid the roar of engines and the clang of hammers, where the strongest powers of nature are trained to work in the fairy chains of art, how softly falls upon the ear the accent of science, the friend of that art and the guide of that industry! Here, where Priestley analysed the air, and Watt obtained the mastery over steam, it well becomes the students of nature to gather round the standard which they carried so far into the fields of knowledge. And when, on other occasions, we meet in quiet colleges and academic halls, how gladly welcome is the union of fresh discoveries and new inventions with the solid and venerable truths which are there treasured and taught. Long may such unions last—the fair alliance of cultivated thought and practical skill—for by it labour is dignified and science fertilised, and the condition of human society exalted!

"Through this happy union of science and art, the young life of the British Association—one-third of a century—has been illustrated by discoveries and enriched by useful inventions in a degree never surpassed. How else could we have gained that knowledge of the laws of nature which has added to the working strength of a thousand millions of men the mightier power of steam, extracted from the buried ruins of primeval forests their treasured elements of heat and light and colour, and brought under the control of the human finger, and converted into a messenger of man's gentlest thoughts the dangerous mystery of the lightning."

The President discussed the question of the velocity of light, and explained why "the distance of the earth from the sun must be reduced from above ninety-five to less than ninety-three millions of miles, and by this scale the other space-measures of the solar system, excepting the diameter of the earth and the distance and diameter of the moon, would be corrected."

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"Spectral analysis, that new and powerful instrument of chemical research for which we are indebted to Kirchhoff, has been taught by our countrymen to scrutinise not only planets and stars, but even to reveal the constitution of the nebulæ, those mysterious masses out of which it has been thought new suns and planets might be evolved. The latest results of spectral analysis of stars and nebulæ by Mr. Huggins and Professor W. A. Miller, show that the nebulæ are indeed found to have in some instances stellar points, but they are not stars; the whole resembles an enormous mass of luminous gas, with an interrupted spectrum of three lines, probably agreeing with nitrogen, hydrogen, and a substance at present unknown. Stars tested by the same accurate hands are found to have a constitution like that of our own sun, and, like it, to show the presence of several terrestrial elements—as sodium, magnesium, iron, and very often hydrogen.

"To aid researches into the condition of celestial bodies, the new powers of light, discovered by Niepce, Daguerre, and Talbot have been employed by Bond, Draper, De la Rue, and other astronomers. To our countryman, in particular, belongs the honour of successful experiments on the rose-coloured flames which extend from certain points of the sun's border during an eclipse; as well as of valuable contributions through the same agency to that enlarged survey of the physical aspect of the moon, which, since 1852, the Association has striven to promote."

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"As we ascend above the earth, heat, moisture, and magnetic force decrease, the velocity of wind augments, and the proportion of oxygen and nitrogen remains the same. The decrease of heat as we rise into the air is no new subject of inquiry, nor have the views respecting it been very limited or very accordant. Leslie considered it mathematically in relation to pressure; Humboldt gave the result of a large inquiry at points on the earth's surface, unequally elevated above the sea; and finally, Mr. Glaisher and Mr. Coxwell, during many balloon ascents to the zones of life-destroying cold, far above our mountain tops, have obtained innumerable data, in all seasons of the year, through a vast range of vertical height. The result is to show much more rapid decrease near the earth, much slower decrease at greater elevations. The proportion of carbonic acid gas in the atmosphere at great heights is not yet ascertained."

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"Researches of every kind have so enriched meteorology since our early friend, Professor J. Forbes, printed his suggestive reports on that subject; and so great have been the benefits conferred on it by the electric telegraph, that at this moment in M. Leverrier's observatory at Paris, and the office so lately presided over by Admiral Fitzroy in London, the messages are arriving from all parts of Europe to declare the present weather, and furnish grounds for reasonable expectation of the next probable change. The gentle spirit which employed this knowledge in the cause of humanity has passed away, leaving an example of unselfish devotion in a work which must not fail through any lack of energy on the part of this Association, the Royal Society, or the Government."

Having touched on various other subjects, the President passed on to the consideration of the present state of geological science. On the question of the antiquity of organic life on the earth, he said :—

"Was the earth ever uninhabited, after it became a globe turning on its axis and revolving round the sun? Was there ever a period since land and sea were separated —a period which we can trace—when the land was not shaded by plants, the ocean not alive with animals? The answer, as it comes to us from the latest observation, declares that in the lowest deposits of the most ancient seas in the stratified crust of the globe, the monuments of life remain. They extend to the earliest sediments of water, now in part so changed as to appear like the products of fire. What life? Only the simpler and less specially organised fabrics have as yet rewarded research among these old Laurentian rocks—only the aggregated structures of Foraminifera have been found in what, for the present at least, must be accepted as the first deposits of the oldest sea.

"Then step by step we are guided through the old Cambrian and Silurian systems, rich in Trilobites and Brachiopoda, the delights of Salter and Davidson; with Agassiz and Miller and Egerton we read the history of the strange old fishes of the Devonian rocks; Brongniart, and Göppert, and Dawson, and Binney, and Hooker unveil the mystery of the mighty forests now converted to coal; Mantell and Owen and Huxley restore for us the giant reptiles of the Lias, the Oolite, and the Wealden; Edwards and Wright almost revive the beauteous corals and echinodermata; which with all the preceding tribes have come and gone before the dawn of the later periods, when fragments of mammoths and hippopotami were buried in caves and river sediments to reward the researches of Cuvier and Buckland, Prestwich and Christy, Lartet and Falconer.

"And what is the latest term in this long series of successive existence? Surely the monuments of ever-advancing art—the temples whose origin is in caverns of the rocks; the cities which have taken the place of holes in the ground, or heaps of stones and timber in a lake; the ships which have outgrown the canoe, as *that* was modelled from the floating trunk of a tree, are sufficient proof of the late arrival of man upon the earth, after it had undergone many changes and had become adapted to his physical, intellectual, and moral nature. Compared with the periods which elapsed in the accomplishment of these changes, how short is the date of those yet standing monoliths, cromlechs, and circles of unhewn stone which are the oldest of human structures raised in Western Europe, or of those more regular fabrics which attest the early importance of the monarchs and people of Egypt, Assyria, and some parts of America! Yet tried by monuments of natural events which happened within the age of man, the human family is old enough in Western Europe to have been sheltered by caverns in the rocks, while herds of reindeer roamed in Southern France, and bears and hyænas were denizens of the South of England. More than this, remains of the rudest human art ever seen are certainly found buried with and are thought to belong to races who lived contemporaneously with the mammoth and rhinoceros, and experienced the cold of a Gallic or British winter, from which the woolly covering of the wild animals was a fitting protection."

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"Various questions of romantic interest in the study of the distribution and languages of the family of man are part of a large circle of the inquiry which finds sympathy in several of our sections, especially those devoted to Zoology, Physiology, and Ethnology. Let us not expect or desire for them a very quick, or, at present, a very definite settlement. Deep shadows have gathered over all the earlier ages of mankind, which perhaps still longer periods of time may not avail to remove."

After further enlarging on the question of the antiquity of man, the President passed to the consideration of the analogy existing among all parts of the animal kingdom, and in a general sense among all the forms of life, which had become more and more the subject of special study.

"Whether what we call species are so many original creations or derivations from a few types or one type, is discussed at length in the elegant treatise of Darwin,* himself a naturalist of eminent rank. It had been often discussed before. Nor will any one think lightly of such inquiries, who remembers the essay of Linnæus, "De Telluris orbis incremento," or the investigations of Brown, Pritchard, Forbes, Agassiz, and Hooker regarding the local origin of various species, genera, and families of plants and animals, both on the land and in the sea. Still less will he be disposed to undervalue its importance, when he reflects on the many successive races of living forms more or less resembling our existing quadrupeds, reptiles, fishes, and mollusca, which appear to have occupied definite and different parts of the depths of ancient time. Is the living elephant of Ceylon the lineal descendant of that mammoth which roamed over Siberia and Europe, and North America, or of one of those sub-Himalayan tribes which Dr. Falconer has made known, or was it a species dwelling only in circum-polar regions? Can our domestic cattle, horses, and dogs, our beasts of chace and our beasts of prey, be traced back to their source in older types, contemporaries of the urus, megaceros, and hyæna on the plains of Europe? If so, what range of variation in structure does it indicate? if not so, by what characters are the living races separated from those of earlier date?

"Specific questions of this kind must be answered, before the general proposition, that the forms of life are indefinitely variable with time and circumstance, can be even examined by the light of adequate evidence. That such evidence will be gathered and rightly interpreted, I for one neither doubt nor fear.

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"How important, in the view of this and many other questions, is that never-tiring spirit of geographical and maritime discovery, to which through four hundred years Europe has sent her noblest sons and her most famous expeditions; sent them, alas! too often to an early grave. Alas! for Franklin, who carried the magnetic flag into the icy sea from which he had already brought trophies to science! Alas! for Speke, who came home with honour from the head waters of the Nile! Forgotten they can never be, whenever on occasions like this, we mourn the absence of our bravest and our best; praise, never-ending praise be theirs, while men retain the generous impulse which prompts them to enterprises worthy of their country and beneficial to mankind.

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"Waves—their origin, the mechanism of their motion, their velocity, their elevation, the resistance they offer to vessels of given form, these subjects have been firmly kept in view by the Association, since first Professor Challis reported on the mathematical problems they suggest, and Sir J. Robinson and Mr. Scott Russell undertook to study them experimentally. Out of this inquiry has

* On the Origin of Species, 1859.

come a better knowledge of the forms which ought to be given to the 'lines' of ships, followed by swifter passages across the sea, both by sailing vessels and steamers, of larger size and greater lengths than were ever tried before."

After referring to the labours of the British Association in various other directions, particularly in the promotion of meteorological science, the President went on to say:—

"When we enter the domain of practical art, and apply scientific methods to test a great process of manufacture, we do not fail of success; because we are able to join in united exertion the laborious cultivators of science and the scientific employers of labour.

"Am I asked to give an example? Let it be iron, the one substance by the possession of which, by the true knowledge and right use of which, more than by any other thing, our national greatness is supported. What are the ores of iron—what the peculiarities and improvements of the smelting processes—what the quality of the iron—its chemical composition—its strength in columns and girders as cast-iron; in rails and boiler plate, in tubes, and chains, as wrought iron—what are the best forms in which to employ it, the best methods of preserving it from decay;—these and many other questions are answered by special reports in our volumes, bearing the names of Barlow, Mallet, Porter, Fairbairn, Bunsen, Playfair, Percy, Budd, Hodgkinson, Thomson; and very numerous other communications from Lucas, Fairbairn, Cooper, Nicholson, Price, Crane, Hartley, Davy, Mushet, Hawkes, Penny, Scoresby, Dawes, Calvert, Clark, Cox, Hodgkinson, May, Schafhaeutl, Johnston, Clay, and Boutigny. Beyond a question, a reader of such of these valuable documents as relate to the strength of iron, in its various forms, would be far better informed of the right course to be followed in experiments on armour-plated ships and forts to resist assault, and in the construction of ordnance to attack them, than he is likely to be from merely witnessing a thousand trials of the cannon against the target. Anyone who remembers what the iron furnace was forty years ago, and knows its present power of work; or who contrasts the rolling mills and hammers of other days with the beautiful machines, which now, with the gentlest motion but irresistible force, compel the strong metal to take up the most delicately moulded form; will acknowledge, that within the period since the British Association began to set itself to the task of reconciling the separated powers of Theory and Experience, there has been a total change in the aspect of each, to the great advantage of both."

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The President concluded as follows:—

"Such, gentlemen, are some of the thoughts which fill the minds of those who, like our Brewster, and Harcourt, and Forbes, and Murchison, and Daubeny, stood, anxious but hopeful, by the cradle of this British Association; and who now meet to judge of its strength and measure its progress. When, more than thirty years ago, this Parliament of Science came into being, its first child-language was employed to ask questions of Nature; now, in riper years, it founds on the answers received further and more definite inquiries directed to the same prolific source of useful knowledge. Of researches in science completed, in progress, or in beginning, each of our annual volumes contains some three hundred or more passing notices, or full and permanent records. This digest and monument of our labours is indeed in some respects incomplete, since it does not always contain the narrative or the result of undertakings which we started, or fostered, or sustained; and I own to having experienced on this account once or twice a feeling of regret. But the regret was soon lost in the gratification of knowing that other and equally beneficial channels of publication had been found, and that by these examples it was proved how truly the association kept to the real purpose of its foundation, 'the advancement of science,' and how heartily it rejoiced in this advancement without looking too closely to its own share in the triumph. Here, indeed, is the stronghold of the British Association. Wherever and by whatever means sound learning and useful knowledge are advanced, there to us are friends. Whoever is privileged to step beyond his fellows on the road of scientific discovery, will receive our applause, and, if need be, our help. Welcoming and joining in the labour of all, we shall keep our place among those who clear the roads and remove the obstacles from the paths of science; and whatever be our own success in the rich fields which lie before us, however little we may now know, we shall prove that in this our day we knew at least the value of knowledge, and joined hearts and hands in the endeavour to promote it."

ON THE COMMERCIAL USE OF FLOWERS.

By Eugene Rimmel.

(Author of the "Book of Perfumes," &c.)

(*Continued from page* 649.)

The number of flowers used for perfumery purposes has hitherto been limited to seven, viz., rose, jasmin, orange, violet, jonquil, tuberose, and cassie. The rose used is the hundred-leaved rose (*Rosa centifolia*), the jasmine is the *Jasminum grandiflorum*, the orange is the bitter orange (*Citrus bigaradia*), and the violet the *Viola odorata*, or double parma violet.

Tuberose (*Polyanthes tuberosa*).

Tuberose (*Polyanthes tuberosa*) and jonquil (*Narcissus jonquila*) are two bulbous plants, and the cassie (*Acacia farnesiana*) a pretty shrub with globular golden flowers, which thrives admirably in the south of France.

Cassie (*Acacia farnesiana*).

Out of those flowers four only are distilled and yield essential oils, viz., rose, orange, jasmine, and cassie. Rose gives the far-famed otto, which is principally made in Turkey, near Adrianople. Orange flowers produce what is called neroly, a name derived from *nero olio*, dark oil, and not, as some people have imagined, from its having been discovered in the time of Nero, for the Romans were totally ignorant of the art of distillation. Jasmine and cassie are only distilled, to my knowledge, in Northern Africa (Algeria and Tunis) and in India, European flowers not possessing a sufficiently intense fragrance.

The aroma of the other flowers is extracted by means

of absorption or maceration. Several other flowers besides those named are sometimes submitted to these processes, such as mignionette, lilac, hawthorn, wall-flower, lily, heliotrope, sweet-pea, &c., but the quantities obtained are so small that they have hitherto been mere experiments, and we are still obliged to compound all these perfumes artificially by studying resemblances and affinities, and blending the shades of scent as a painter does the colours on his palette. Thus, for instance, we imitate heliotrope with the aid of vanilla, sweet-pea by a mixture of rose and orange flowers, magnolia with tuberose, orange flower, and a dash of lemon, &c.

Flowers for perfumery purposes are principally grown in the neighbourhood of Grasse, Cannes, and Nice, three towns situated in the South of France, close to each other. The manufacture of perfumery materials forms one of the principal branches of industry in that district, giving employment to upwards of ten thousand people, including many women and children, for whom the work of culling flowers and picking off the stalks is particularly suitable. These flowers are generally grown by small farmers, who contract with the perfumers for their crop, with the exception of orange flowers, which are always sold on the market. The prices flowers realize vary a good deal, according to the abundance of the crop. They average as follows:—

		s.	d.		s.	d.	per lb.
Roses	from	0	4	to	0	8	,,
Orange flowers	,,	0	6	,,	0	10	,,
Jasmines	,,	1	0	,,	1	6	,,
Violets	,,	1	6	,,	2	6	,,
Tuberose	,,	1	3	,,	2	0	,,
Cassie	,,	2	0	,,	3	0	,,
Jonquils	,,	1	0	,,	1	6	,,

The following are approximate quantities and values of the flowers consumed for perfumery purposes in that locality alone:—

	lbs.		£
Orange flowers	2,000,000	worth about	50,000
Roses	600,000	,,	15,000
Jasmines	150,000	,,	8,000
Violets	60,000	,,	6,000
Cassie	80,000	,,	6,000
Tuberose	40,000	,,	3,000

The principal plants from which essential oils are made are lavender (*Lavandula vera*), spike (*Lavandula spica*), peppermint (*Mentha piperita*), rosemary (*Rosmarinus officinalis*), thyme (*Thymus vulgaris*), wild thyme (*Thymus serpyllum*), and marjoram (*Origana majorana*), which all grow wild in the neighbouring mountains, and are distilled on the spot by means of portable stills. An essential oil is also extracted from geranium (*Pelargonium odoratissimum*), which, from its strong *rosy* flavour is much prized by perfumers, and the bitter orange leaves yield a powerful essence named *Petit-grain*, which is used in eau de Cologne. The following table gives the average quantities of flowers and plants required to make 1lb. of essential oil.

Quantities of Flowers, &c., required to make One Pound of Essential Oil.

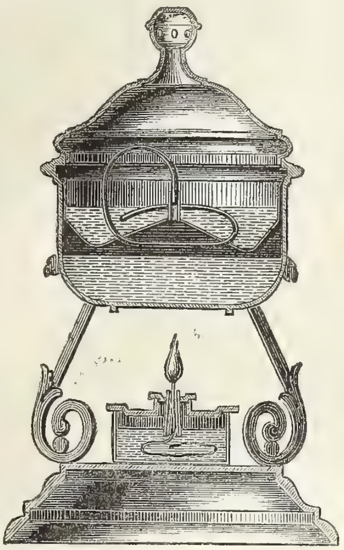
	lbs.
Roses (*Rosa centifolia*)	10,000
Orange flowers (*Citrus bigaradia*)	1,000
Orange leaves ,,	500
Geranium (*Pelargonium odoratissimum*)	500
Lavender (*Lavandula vera*)	120
Spike (*Lavandula spica*)	80
Thyme (*Thymus vulgaris*)	200
Wild thyme (*Thymus serpyllum*)	200
Rosemary (*Rosmarinus officinalis*)	100

It has been proposed to cultivate flowers in England for perfumery purposes, but the climate renders this scheme totally impracticable. English flowers, however beautiful in form and colour they may be, do not possess the intensity of odour required for extraction, and the greater part of those used in France for perfumery would only grow here in hot-houses. The only flower which might be had in abundance would be the rose, but the smell of it is very faint compared with that of the Southern rose, and the rose-water made in this country can never equal the French in strength. If we add to this the shortness of the flowering season, and the high price of land and labour, we may arrive at the conclusion that such a speculation would be as bad as that of attempting to make wine from English grapes. As a proof of this, I may mention that I had a specimen submitted to me not long since of a perfumed pommade which a lady had attempted to make on a flower-farm, which she had been induced to establish in the north of England, and it was, as I expected, a complete failure. The only two perfumery ingredients in which the English really excel are lavender and peppermint, but that is owing to the very cause which would militate against the success of other flowers in this country, for our moist and moderate climate gives those two plants the mildness of fragrance for which they are prized, whilst in France and other countries they grow strong and rank.

Before I take leave of the subject of distillation, I may be allowed to mention my system of vaporizing perfumes, which is a sort of inverted distillation, for whilst the object of distilling is to concentrate the aroma of fragrant substances, that of vaporizing is to divide it *ad infinitum*. I was led to this discovery in a very curious way. Some years ago, Madame Céleste was bringing out at the Lyceum a new fairy piece, called "Chrystabelle; or, the Rose without a Thorn." The great transformation scene was to represent a bower of roses, and she came to me to ask if I could supply her with some means of diffusing the scent of roses during that scene. My first answer was that it could not be done, as the various systems for perfuming the air had been hitherto confined to the combustion of aromatic gums and woods, which all gave an incense flavour very unlike roses. On thinking over the matter, however, it struck me that steam, owing to its great power of extension, might be used as a vehicle for carrying fragrant molecules in a rapid and powerful manner through the atmosphere. I constructed an apparatus on this principle, and the experiment succeeded so well that the perfume vaporizer has been used extensively since, not only for scenic effects, but also on a reduced scale in ball-rooms, apartments, &c. The peculiar advantage of this system is to give the fragrance of any particular flower in all its purity; thus on the day of the marriage of the Prince of Wales, the reception rooms adjoining St. George's Chapel, which had been perfumed in that way, breathed an atmosphere of violets, though none were to be seen. The potency of these vapours is also so great that a large theatre like Her Majesty's or Covent Garden is entirely filled with them in five minutes. Now, by substituting aromatic plants for flowers, you produce reviving fumes, which have been thought sufficiently prophylactic to be adopted by the Royal College of Surgeons and several hospitals. The question has been discussed and not satisfactorily settled, whether these aromatic fumes *destroy* or only *cover* unpleasant and deleterious smells—but it is very certain that they render them totally imperceptible, and that is a great point gained. There is a very curious fact connected with these scented vapours, which is that the weakest perfume, such as that of violet, is sufficient to overcome a strong persistent smell like that of tobacco. I have often tried this experiment myself by lighting a small vaporizer in a room where several persons had been or were still smoking, and in the course of a few minutes nothing but the perfume was perceptible. I shall feel much obliged to any scientific man who can give me the cause of this phenomenon.

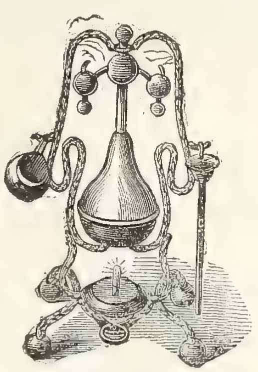
The apparatus usually employed for vaporising perfumes consists in a water-bath containing a pan fitted with a bent pipe, the lower end of which is bored with small holes. Perfumed water is placed in the water-bath, and

the prepared scent in the pan; heat is then applied by means of a spirit lamp, and the steam evolved from the water-bath passes through the pipe into the upper vessel,



Sectional View of Perfume Vaporiser.

where it meets with the perfume and causes it to rise in a vapour through the apertures on the top. A more simple apparatus is also used where the perfume is merely boiled, and when only required for a few minutes; and in a small room, it answers as well as the other. The re-



The Revolving Vaporiser.

volving vaporizer, a recent modification of the apparatus is placed on a pivot, and has on the top two very small apertures placed in a contrary direction. It is poised in such a way that the steam, as soon as it is generated, rushes through the apertures and causes it to revolve with great rapidity.

The fourth process I have to describe to you is that of *expression*, which is confined to the fruits of the citrine family, viz., orange (*Citrus aurantium*), bitter orange (*Citrus bigaradia*), lemon (*Citrus medica*), bergamot (*Citrus bergamia*), cedrate (*Citrus cedrata*), and limette (*Citrus limetta*). The rinds of all these fruits contain an essential oil ready formed in small vesicles, and various means are adopted to extract it. On the coast of Genoa they rub the fruit against a grated funnel; in Sicily they press the rind in cloth bags, and in Calabria, where the largest quantity is manufactured, they roll the fruit between two bowls, one placed inside the other, the concave part of the lower and the convex part of the upper being armed with sharp spikes. These bowls revolve in a contrary direction, causing the small vesicles on the surface of the fruit to burst and give up the essence they contain, which is afterwards collected with a sponge. The rinds are also sometimes distilled, but the former processes, which are called in French *au zest*, give a much finer essence.

The three principal essences of this kind used are orange (called also Portugal), lemon, and bergamot, which all enter into the composition of eau de Cologne and many other perfumes. They are made in Calabria and Sicily in the months of October, November, and December, and the quantity of fruits required to made 1 lb. of essential oil varies as follows during that time:—

	October.	November.	December.
Oranges	1,500	... 2,000	... 2,300
Lemons	1,500	... 1,800	... 2,000
Bergamots	1,800	... 2,000	... 2,300

The essence produced by squeezing the rind is yellow; that made with the machine has a green tint. The following quantities are produced yearly on an average:—

	lbs.		Fruits.
Orange ...	300,000	made with about	540,000,000
Lemon ...	500,000	,, ,,	750,000,000
Bergamot	300,000	,, ,,	600,000,000

Perfumery is not the only use to which are put aromatic flowers and plants; vast quantities are also gathered and sold for medicinal purposes, especially on the continent; but as this part of my subject belongs to the domains of pharmacy, I must leave it to be treated by a more competent person than myself.

In conclusion, allow me to return you my very best thanks for your kind and courteous attention, and to say that if any of you feel any particular interest in the subject I have had the pleasure of introducing to your notice, they will find in the book I lately published all particulars respecting the history of ancient and modern perfumery.

Fine Arts.

Paris Exhibition of Fine Arts Applied to Industry.—The collection of porcelain and *faïences* shown here is very remarkable, and includes specimens from almost every country and every style—French, Italian, German, and Oriental, very many of the pieces being of extreme rarity. Amongst the enamels, those of Limoges are naturally the most numerous; but the collection of Italian and other historical works is extremely fine. Next in importance are the classes of furniture, tapestry, ironwork, and other objects of domestic utility and decoration, ranging from the 16th to the 18th century, and in many cases having historic as well as artistic interest. The collection of armour and arms, ancient and modern, European and Oriental, which is already a fine one, will shortly receive a very important addition; the Emperor recently paid a visit to the Exhibition, and offered his fine private collection of arms to the director. The arms in question occupy a special gallery in the Tuileries, and consist of about a thousand pieces, principally of the period of the middle ages and the renaissance. A separate room is being prepared for their reception. The Venetian and other glass forms another important feature in the Exhibition. The carved works in ivory and wood also present many fine specimens of mediæval skill. There are good collections of small bronzes of the 15th, 16th, and 17th centuries; of old German and other silver ware; of enamelled and jewelled snuffboxes; *bonbonnières*, and other small articles. In the modern portion of the Exhibition the works are classed under nine heads:—

Decoration of buildings, wall decorations, furniture, works in metal, precious metals and costly substances, glass and ceramic wares, tissues for clothing and domestic use, miscellaneous articles, including carriages, arms, cutlery, bookbinding, and ornaments; and lastly, printing, engraving, and photography. The iron work applied to architectural and domestic purposes exhibits decided progress, especially that in which the ornamentation is produced by the hammer in the old style. A pair of park gates, pedestals and brackets for lamps, chandeliers, fire-dogs, fire-irons, and many other articles, exhibit great manual dexterity, coupled with simplicity and purity of design. Of chased, enamelled, and decorated goldsmiths' work there are some beautiful examples in the Exhibition; a portable communion service, or *chapelle*, as it is called, in silver gilt, engraved and studded with precious stones, exhibited by M. Geffroy, of which the forms, the engraving, and the whole of the workmanship are solid and extremely elegant; a silver beer tankard decorated with hopbine in *repoussé* work in the old German style, by M. Fannière; a silver gilt casket, ornamented with enamels and set with stones, from the well-known house of Froment Meurice; cups and other articles in steel, chased, engraved, and ornamented in the style of Louis the Thirteenth, by M. Philippe; a noble vase and other works in silver, chased and oxidized, by Rudolphi; silver and plated ware exhibited by M. Veyrat, and many other remarkable works of the same kind. Porcelain and *faïence*, especially the latter, also exhibit the same spirit of artistic revival, not yet quite so fully developed. In the exhibition are many direct reproductions of the works of Palissy and other famous potters, executed with more or less ability, but there are also innumerable specimens of the judicious application of the old styles to modern taste. The large vases and other objects in *faïence* scarcely exhibit so much skill in their manufacture as many of the productions of our own makers, but the decorated slabs and medallions exhibit a rare amount of artistic talent, and in some the colours are perfect, especially the blue. At present the cost of this artistic pottery is high, but it is evident that the time is approaching when they will be brought within the reach of almost everyone, and a brighter and more durable species of decoration it is hardly possible to imagine. French cutlery is another branch of manufacture which is making great strides, and the specimens in the Exhibition deserve special attention. Bronzes, gilt, and other ornamental wares for which Paris has so deserved a reputation are, of course, well represented, but they present no special progress or novelty.

Public Statues in France.—A grand *fête* took place last week at Villiers Bocage, a small place not far from Caen, in Normandy, at the inauguration of the statue of Richard Lenoir, who for forty years laboured with the greatest energy, and did the most signal service for the French cotton manufacture, and yet, after being one of the wealthiest manufacturers in France, and having laid the foundation of thousands of fortunes, died a poor man. The statue, by Louis Rochet, is one of the happiest efforts to give dignity to a costume of the most ungainly and unpromising character; the large frock-coat of the empire, with its square, stiff, prominent collar, which the artist has treated with daring exactitude, artistically seizing upon the ample skirt to break the formality of the effect, and give a flowing form to his outline. Richard Lenoir, besides being an industrial hero, and almost a martyr, engraved his name on the memory of his countrymen by placing himself at the head of his workmen and aiding in the last struggle against the legitimists and their allies in 1815. Villiers Bocages, the place of his birth, does not contain more than twelve hundred inhabitants, but thousands flocked to the inauguration from all parts of France. A statue has also been raised in honour of the astronomer Arago, at his birth-place, Estagel, in the department of the Pyrenées Orientales; the sculptor, M. Oliva, is also a native of the Pyrenées.

Manufactures.

Copper Smoke.—The following is from the *Reader*:—Several ineffectual attempts have been made, during the last fifty years, to abate the nuisance caused by the copper smoke which is given off during the calcining of the ore. Copper-smelters are in the habit of paying large sums as compensation for the damage done to the vegetation in the neighbourhood of their works by the clouds of valuable copper smoke which are allowed to pass into the air. Thousands of pounds are annually wasted in this manner; but up to the present time no plan has been found to answer practically for utilizing the smoke. Messrs. Vivian and Sons, the eminent copper-smelters of Swansea, who have already made great efforts in this direction, are about to adopt an improved roasting furnace, for which the inventor, M. Gerstenhöfer, a chemist of Freiberg, took out a patent in 1863. It has hitherto been the practice to perform the roasting operation either in kilns, grate furnaces, or muffles. In the first case, the stamped ores are mixed with clay or loam, and formed into balls, which are then dried. When muffles are used, the pounded pyrites is spread on plates of fire-clay, and required to be kept continually stirred to expose fresh surfaces to the air. Neither of these processes answers practically. M. Gerstenhöfer's improved furnace is described as consisting of "a vertical chamber, constructed of fire-brick, and fitted with a series of horizontal bearers (formed of fire-brick) distributed evenly through the body of the furnace, for the purpose of intercepting, and thereby distributing the crushed ore as it is discharged through the top of the furnace from suitable feeding boxes. * * * * The upper face of the bearers is made flat, to receive the ore, and after accumulating on the upper bearer it slides off on to those lower down, and so on, until it finally falls to the bottom of the furnace, at which time it is supposed to have parted with its sulphur." The gases, passing out at the mouth of the furnace, are led into a large chamber; first, however, heating the pipes which supply air to the grate, where they deposit "the dust of roasted ores, and also the arsenious acid." The gases are now ready to pass into the ordinary sulphuric acid chambers. The inventor states in his specification that "the Royal Saxon Sulphuric Acid Works have made a trial with a furnace of the improved construction with so great a success that it is now almost exclusively employed for the roasting of pyrites at that establishment." The working of this furnace has been carefully investigated by Messrs. Vivian, who expect to make 1,000 tons of sulphuric acid per week from the copper smoke, which would otherwise be worse than wasted. We are, therefore, not surprised to hear that Messrs. Vivian have paid the inventor £4,000 for his patent right.

Wakefield Industrial and Fine Art Exhibition.—This exhibition was opened by the president, Lord Houghton, on Wednesday, 30th August. The inaugural address was delivered by the president, after which the Archbishop of York and other gentlemen spoke at length on the advantages to be derived from such exhibitions. The building in which the exhibition is held consists of a lare vestibule, with a picture gallery on either side. Besides these galleries, the temporary building contains a large central hall, 100ft. by 60ft., and a refreshment room. The Tammy Hall is entered by steps from the central hall, and contains, besides offices, a lower room with shafting, which, in consequence, has been assigned to machinery in motion; above this is an upper room, the walls of which are covered with a neutral tint. The exhibition is held in six rooms, which contain about 17,000 square feet of floor and table space, and 17,000 square feet of wall space. The number of exhibitors, including the fine arts department and children, amount to 1,300.

Exhibition at the Saracen Foundry, Glasgow.—A private exhibition of the articles produced in the leisure

hours of the workmen in this establishment was recently held in the Moulders' Shop, which had been set apart for the purpose. The origin of so novel an attempt was as follows:—For several years back the moulders have been in the habit, on the occasion of their annual excursion in August, of decorating their sand heaps with devices of various kinds, and last year so much talent was displayed in this respect, that the company awarded prizes to the more remarkable of the designs, and intimated that next year they would award prizes to the amount of £22 2s., in connection with a private industrial exhibition in the foundry, which would include not only specimens of the men's own ingenuity, but also that of their families and of their female friends. The employés themselves subscribed an equal amount, and the result was the present exhibition. One rule of the exhibition was a rather noticeable one, namely, that no articles were allowed to be exhibited illustrating the company's manufacture, so that the specimens on view were in an unusual degree the result of natural genius. There were in all eight sections —namely, 1. For the best object in either nature, art, or industry. 2. For the best essay delivered at the Saracen Foundry Mutual Improvement Society during the session 1864 5. 3. For the best object or decoration made in moulding sand by journeyman moulders. For the best object or decoration made in moulding sand by apprentice moulders. 4. For the best specimen of female industry in needlework, knitting, &c. 5. For the best drawing. 6. For the best original composition in prose or verse. 7. For the best writing. 8. For the best specimen of writing by counting-house employés only. In one of these sections there were 36 competitors, and in another 24, and many of the articles shown were such as to reflect highly on the skill and industry of the exhibitors. The third section was in many respects the most interesting of all, comprising as it did numerous and curious designs in moulding sand. The first prize was for an elaborate design illustrative of the parable of the Good Shepherd; and the second for an imitation of Burns' monument. Mr. Walter Macfarlane, of the Saracen Foundry Company, delivered an address, and distributed the prizes.

Commerce.

Coffee.—Messrs. Travers' circular says:—"The progressive decline in the consumption of coffee is surprising, as the quantities of nearly all other articles of produce have become much greater of late years. The home consumption reached its highest point for the last fifteen years in 1854, when it amounted to 16,674 tons; in 1864 it was only 14,000 tons, and we have now to chronicle a decrease of 315 tons for the first six months of 1865, as compared with the corresponding part of 1864. The reduced cost of tea, and the rapid advance it has made in public favour, have principally brought about this result; but, at the same time, the smaller use of coffee may, to a great extent, be traced to the way in which it is generally prepared in England. The preparation of coffee for use requires some little care and attention, which are seldom bestowed upon it by English people. The result is that we, as a nation, drink the worst-flavoured coffee in Europe, although we are supplied with the best raw material, and can pay the best price for it. The preparation of tea, on the other hand, requires little care, and the result is always certain, if enough be put in the pot. Labour being dear and time of value, coffee in England goes to the wall, and tea usurps its place. On the continent the contrary is the case, and coffee is as yet in the ascendant. England is the chief *entrepôt* from which continental supplies are drawn; and we may thus form a tolerably correct inference of the state of consumption abroad by the exports from British ports. These amounted in 1854, when our home consumption was at its highest, to 14,548 tons; but in 1864 amounted to no less than 35,406 tons; and the Board of Trade returns for the six months of this year show a surplus of 1,769 tons in the export deliveries, as compared with the first half of 1864. Coffee planters need thus have no fear of extending their operations at present—the more so as the United States will be more and more in the market. At the same time, we fear that the use of coffee in England will be still further diminished by the late reduction in the tea duty."

Coal Trade in Europe.—The extraction of coal in France in 1863 was estimated at 10 million tons, and the import of foreign coal was 5,344,260 tons; the consumption amounted to 882 lbs. per head. Belgium produced 10 million tons, but exported 3,500,000 tons. The $6\frac{1}{2}$ million tons which it consumes represents 2,822 lbs. per head, or three times as much as France. England produces 86 million tons of coal, of which 7,934,000 tons were exported. The internal consumption, therefore, is about 78 million tons, which represents 6,394 lbs. per head, or about seven times as much as in France. One-third of the coal used in France is imported from England, Belgium, and Prussia.

Clocks and Watches Imported.—From a return recently issued, it appears that in the seven months ended the 31st July, as many as 129,082 clocks and 86,814 watches were imported free of duty.

Colonies.

Progress in New South Wales.—The increase of population by immigration to New South Wales, from 1860 (after separation from Queensland) to 1864 inclusive, has been—Immigrants, arrived under Government Assisted Immigration Regulations, 15,903; other arrivals from Great Britain, in excess of departures to Great Britain in five years, only 1,495; arrivals by sea from other colonies and foreign ports in excess of departures to same, 480; arrivals by sea of Chinese in excess of departures, 5,721; total, 23,599. Notwithstanding the depression of the times, the purchase of land by free settlers goes on rapidly. The total quantity purchased from the time when the Act came into operation (1st January, 1862) to 30th September, 1864 (2 years and 9 months), being no less than 630,653 acres, and the sum paid as deposits alone during that time amounting to nearly £160,000. The following figures give the number of purchasers and the quantity of land selected in 1864:—

Year.	Acres.	No. of Purchasers.
1862	294,186	4,562
1863	212,035	3,551
1864 to Sept. 30	124,432	1,890
	630,653	10,003

From almost every district the most encouraging statements respecting the progress the colonists are making are received.

Silver Mines in New South Wales.—It has been determined to resume operations at the Mornya Silver Mines by a new process, which has been tried with a model machine on the ores of this mine, and which is stated to have been completely successful in extracting the precious metals. Two trials have been made on the ore with very satisfactory results, the first trial giving four ounces of gold and ten ounces of silver to the ton of ore, and the second trial giving three ounces of gold and fourteen ounces of silver to the ton of ore.

New Tariff in New South Wales.—The act to impose stamp duties would come into operation on the 1st of July. It is estimated that the revenue to be derived from these duties will amount to £150,000. On the 25th May the treasurer proposed an addition of 20 per cent. customs duties on all goods included in the tariff, and a duty of 1s. on all goods imported into the colony. The resolutions submitted to the Assembly met with some opposition, and were amended by exempting tea, sugar, brandy, and gin from the package duty.

Copper Mines in New South Wales.—The reports from these mines continue to be of a satisfactory character. The quality of ore is improving, and the lodes are more productive as depth is obtained.

Notes.

City Horticulture.—A recent number of the *Scottish Farmer* says that a large number of influential gentlemen in Edinburgh have lately associated themselves for the support of what may be termed a Working-Class City Horticultural or Window Gardening Society. The promoters of this philanthropic movement issued a circular in March last inviting working people to contribute to a flower show for the working classes living in the various districts of Edinburgh. Prizes of sums from 1s. to 5s. were given, open to working men and women; and prizes from 6d. to 2s., open to boys and girls under 15 years of age. Any flowering plant was admitted. In all, 114 prizes were offered. It appears that there are now, both in Edinburgh and Glasgow, some very successful examples of area gardening, where, considerably under the street levels, healthy and well-grown ferns, including that most elegant of all, the *Osmunda regalis*, as well as many kinds of shrubby, herbaceous, and climbing plants, are thriving in vigorous luxuriance, the evil effects of the street dust and city smoke being counteracted by frequent washings of the foliage, and that generally by merely sprinkling it with water from the finely-drilled rose of a small watering-pan, discharged occasionally shower-like from the higher windows, or over the railings from the street above. With regard to the choice of plants for this purpose, the above-named journal says:—"There are many plants which will not thrive under the best management in town windows, areas, &c.,—let all such be discarded; and we would further recommend working-class cultivators not to be too ambitious in their selection, but to choose from observation those plants most suitable, whether native or exotic, hardy or tender. To juvenile growers of hanging pot plants we would say, have an eye to that hardy and pretty woodland native 'creeping jenny,' also called 'herb twopence,' and still more earnedly *Lysimachia nummularia*. Aspire to the possession of a plant of the recently-introduced hardy Japan honeysuckle, which is unsurpassed for the beauty of its golden lace-like foliage; and do not neglect the common ivy, one of the easiest managed of evergreen creepers, and of which there are now about half a hundred varieties in cultivation, all differing from one another in the colour, form, and size of their leaves; and among these, some with variegated and spotted, as well as peculiarly-formed green foliage, are unsurpassed as flower-pot evergreens, either for growing inside or outside. The general attention now and lately bestowed upon window gardening has been the means of calling forth several highly interesting and useful publications and essays on the subject; foremost among which is the paper read by Mr. John Bell before the Society of Arts last session."

Special Education in France.—The Minister of Public Instruction has just issued a circular to the Prefects of departments announcing the intention of the Government to establish a special normal school at Cluny. The object is to create a class of teachers which neither the high schools of Paris nor the primary normal schools supply, instructed in matters connected with the applied sciences, and able to explain to the pupils not only the principles of industrial operations, but also the methods in actual practice. The new school is to be established in the ancient Benedictine abbey at Cluny, a spot well situated for the purpose, being in the centre of a rich province, where all forms of cultivation are to be found—cornland, meadow, vineyard, and forest, near Creuzot, the seat of a great mechanical industry, on the one hand, and Lyons on the other, and not far from St. Etienne; so that the pupil teachers will be placed in very advantageous circumstances. Candidates are to be admitted by competition, in order that all may be nearly on a par as regards general instruction, and the pupils will receive their diplomas after public examination. The school will be open to all on the above conditions, but the Government will support the pupil teachers required for the Lycées. The departments are called upon to aid the work by applying one or two of the scholarships in each primary normal school to the new establishment, the pupil teachers to be selected from the departmental schools by competition. The modes of carrying out the object in question are not yet fully decided on, but the Minister expresses his intention of proposing to the Emperor that the pupils who pass their examination in the new school shall enjoy a portion of the advantages attaching to University degrees; and announces further that as the professors of the new school must be men of high standing, and as the laboratories, workshops, collections, gardens, and other means of practical study, must be complete, the value of each *bourse* will be higher than in the ordinary normal schools, and he fixes it at eight hundred francs (£32).

Patents.

From Commissioners of Patents Journal, September 1st.

Grants of Provisional Protection.

Copying presses—1624—P. Lawrence and G. Jeffreys.
Fuel, combustion of in furnaces, &c.—1972—B. Robinson & J. Varley.
Illusory exhibitions—1983—T. W. Tobin and Colonel Stodare.
Iron—1964—E. Sabel.
Iron—1970—W. W. Biggs.
Levels, &c., adjusting—2065—A. Budenberg.
Roofing tiles and slabs—1991—F. Ransome.
Shells, fuses for—1989—A. Noble.
Ships, water-closets for—1740—H. W. Rosser.
Soils, preparation of—1935—T. Spencer.
Spindles, lubrication of—2059—J. H. Radcliffe.
Steam, apparatus for condensing—1180—A. Francis.
Steam, indicating pressure of—1497—F. N. Gisbourne.
Steam valves, conical plug—1956—W. E. Newton.
Water, drawing—1996—J. McEwan and W. Neilson.

Inventions with Complete Specifications Filed.

Alcohols, distilling and rectifying—2203—H. A. Bonneville.
Elastic subttances, compression of—2205—H. A. Bonneville.
Skate, roller—2221—W. P. Gregg.
Velvet—2204—H. A. Bonneville.

Patents Sealed.

608. H. Taylor.	669. V. Delperdange.
624. F. Cruickshank.	671. E. A. Phillips.
628. W. Riddle.	796. W. M. Williams.
633. E. W. Young.	813. T. H. Saunders.
635. J. H. Wilson.	952. W. Clark.
652. F. W. Turner.	1048. G. Jackson.
662. R. G. Fisher.	

From Commissioners of Patents Journal, September 5th.

Patents Sealed.

634. R. A. Brooman.	737. J. Farrar and E. Booth.
648. J. Shanks.	757. J. McConnell.
649. M. Morgans.	880. A. Chaplin.
660. J. T. Harris.	901. A. Turner.
661. W. H. James.	980. G. Davies.
666. J. Cliff.	1134. J. Howard & E. T. Bousfield.
675. G. Wright.	1562. J. R. Cooper.
680. J. Samuel and S. Millbourn.	1885. G. Nimmo.
693. J. M. Napier.	

Patents on which the Stamp Duty of £50 has been Paid.

2396. F. H. Lefranc.	2540. G. L. Lee.
2401. W. Owen.	2440. Eli Dyson.
2402. P. W. Mackenzie and S. Smith.	2910. A. Krupp.
	2428. R. Glanville.
2492. G. T. Bousfield.	2448. H. L. Emery.
2414. J. Walker.	2450. J. Platt and W. Richardson.
2418. E. G. Fitton.	2519. H. Higgins.
2441. R. A. Brooman.	

Patents on which the Stamp Duty of £100 has been paid.

1965. J. L. Clark, F. Braithwaite, and G. E. Preece.	2001. G. T. Bousfield.
	1980. A. V. Newton.
1971. M. A. F. Mennons.	1988. A. V. Newton.
1987. W. Warne.	1985. J. Sloper.

THE

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AND OF

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111th Session.] FRIDAY, SEPTEMBER 15, 1865. [No. 669. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Examinations for 1866.

The Programme of Examinations for 1866 is now published, and may be had gratis, on application to the Secretary.

Proceedings of Institutions.

Glasgow Mechanics' Institution.—In the forty-second annual report the directors point with a degree of pride to the very prosperous session. With few exceptions the attendance of the classes has been higher than ordinary; while the quality of work accomplished is decidedly superior. With a view to secure a larger attendance in the natural philosophy and chemistry classes, the directors have reduced the fee in these classes to 2s. 6d., entitling students to the membership of the Institution, to attendance on twenty-four lectures, and the use of the library for six months, and the experiment has proved so far successful in both classes. In the Chemistry Class (Dr. W. Wallace) the course of lectures was, this session, devoted to chemical technology, or chemistry applied to manufactures and the useful arts. The number enrolled in the Natural Philosophy Class (Mr. J. P. Smith, C.E.) is 112, and the attendance throughout the session has been little short of that number. The subjects of lectures have been the properties of matter, the principles of mechanics, gravitation, optics, heat, electricity, magnetism, &c. In the Music Class (Mr. Samuel Barr) the teacher was highly pleased with the progress made. The Animal Physiology Class (Mr. John Mayer, F.C.S.), although not numerically strong, has been very successful, both as regards regularity and attendance and the amount of work done. The Elocution Class (Mr. Wm. Moffat) consisted of 22 members, with an average attendance of 16. They have been trained to read distinctly, significantly, and expressively; the progress made by all having been very considerable. The Mechanical Drawing Class (Mr. P. Stewart) has had another very successful session. The classes for Drawing, Painting, and Architecture (Mr. A. D. Robertson) have also been successful. The number enrolled in the class of Practical Mechanics (Mr. J. P. Smith C.E.) is 42, and the attendance throughout the session has been good. The subjects taken up were the principles of mechanics—gravity, strength of materials, theory of structures, principles of equilibrium in simple machines, friction, wheelwork, principles of dynamics, theory of machines, combustion of fuel, generation of steam, steam boilers, &c. A similarly favourable account is given of the English Language and Literature Class (Mr. D. Buchanan). The Writing, Arithmetic, and Book-keeping Class was under Mr. John Macgregor, teacher, and Mr. Robert Stevenson, assistant. The duties of this department had become increasingly arduous, and were, during the past session, shared between the teacher and an assistant. The number of students in attendance demanded all the accommodation available, whilst the work performed was good. In the Mathematics and Arithmetic Class (Mr. A. Thom), the students were arranged into a junior and a senior class. The junior students, in addition to the more advanced rules of arithmetic, read the first three books of Euclid, with the more useful propositions in the fifth and sixth books; algebra, as far as simultaneous equations, and the summation of series. The senior students read the first six, with the eleventh and twelfth books of Euclid; analytical trigonometry, with the application of logarithms to the solution of problems in trigonometry and mensuration. In the senior class the students were permitted to occupy half their time in whatever branch of the science they thought fit, some taking the differential calculus, others trigonometry, mensuration, or navigation. The classes in Latin and Greek (Mr. J. Miller, A.M.) have been attended this session by gentlemen belonging to or preparing for the legal and medical professions; by young men preparing for the University, and by others engaged in commercial and mechanical pursuits. Favourable accounts are given of the French (Mons. Dutoit) and the German (Herr Rehbann) classes. In the Spanish class (Mr. A. Revie) there has been a small increase in the numbers over those of last session, the tickets sold being 49 against 44. Some of the students have made considerable progress. The History and Geography class (Mr. D. Buchanan) and the Botany class (Mr. W. Keddie) have been prosperous. The library contains upwards of 7,000 volumes, a large addition having been made during the year. Besides the students attending the classes, the library is opened to the public at the annual charge of 4s. Considerable additions have been made to the museum, the accommodation of which is now largely extended. The museum is open for the inspection of members and students of the Institution, and friends, free of charge. The tickets sold for the evening classes have been as follows:—Chemistry, 118; Natural Philosophy, 112; Music, 79; Animal Physiology, 19;

Practical Mechanics, 42; Elocution, 22; Botany, 36; Mathematics, 244; Mechanical Drawing, 253; Free-hand and Architectural Drawing, 157; Writing, Arithmetic, and Book-keeping, 384; Grammar, Composition, and Literature, 145; French, 166; German, 36; Spanish, 49; Latin and Greek, 113; Dancing and Calisthenics, 6; History and Geography, 18; total, 1,999. The income has amounted to £2,097 0s. 5½d., and there was cash in hand £375 13s. 4d.

EXAMINATION PAPERS, 1865.

(*Continued from page* 638.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

GERMAN.

THREE HOURS ALLOWED.

Each candidate is expected to translate one of the passages of Section I., to answer some of the questions, and to turn into German several of the sentences and pieces given in Section III. Candidates for a first class, must translate one piece of Section I., answer (*e*), (*f*) and (*g*) of Section II., and render into German 16—20 inclusive, of Section III., and write the essay:—

Section I.

1. Dieser Tag war es, um dessentwillen Gustav das baltische Meer durchschiffte, auf entlegener Erde der Gefahr nachjagte, Krone und Leben dem untreuen Glück anvertraute. Die zwei grössten Heerführer ihrer Zeit, beide bisher unüberwunden, sollen jetzt in einem lange vermiedenen Kampfe mit einander ihre letzte Probe bestehen; einer von beiden muss seinen Ruhm auf dem Schlachtfelde zurücklassen. Beide Hälften von Deutschland haben mit Furcht und Zittern diesen Tag herannahen sehen; bang erwartet die ganze Mitwelt den Ausschlag desselben, und die späte Nachwelt wird ihn segnen oder beweinen.

Die Entschlossenheit, welche den Grafen Tilly sonst nie verliess, fehlte ihm an diesem Tage. Kein fester Vorsatz, mit dem Könige zu schlagen, ebenso wenig Standhaftigkeit, es zu vermeiden. Wider seinen Willen riss ihn Pappenheim dahin. Nie gefühlte Zweifel kämpften in seiner Brust, schwarze Ahnungen umwölkten seine immer freie Stirn. Der Geist von Magdeburg schien über ihm zu schweben.

2. Ist Frieden stiften, Hass
Versöhnen ein Geschäft der Hölle? Kommt
Die Eintracht aus dem ew'gen Pfuhl hervor?
Was ist unschuldig, heilig, menschlich gut,
Wenn es der Kampf nicht ist ums Vaterland?
Seit wann ist die Natur so mit sich selbst
Im Streite, dass der Himmel die gerechte Sache
Verlässt, und dass die Teufel sie beschützen?
Ist aber das, was ich dir sage, gut,
Wo anders als von oben konnt' ich's schöpfen?
Wer hätte sich auf meiner Schäfertrift
Zu mir gesellt, das kind'sche Hirtenmädchen
In königlichen Dingen einzuweihn?
Ich bin vor hohen Fürsten nie gestanden,
Die Kunst der Rede ist dem Munde fremd.
Doch jetzt, da ich's bedarf, dich zu bewegen,
Besitz' ich Einsicht, hoher Dinge Kunde,
Der Länder und der Könige Geschick
Liegt sonnenhell vor meinem Kindesblick,
Und einen Donnerkeil führ' ich im Munde.

3. Alter Freund! immer getreuer Schlaf, fliehst du mich auch wie die übrigen Freunde? Wie willig senktest du dich auf mein freies Haupt herunter, und kühltest, wie ein schöner Myrthenkranz der Liebe, meine Schläfe! Mitten unter Waffen, auf der Woge des Lebens, ruht' ich leicht athmend, wie ein aufquellender Knabe, in deinen Armen. Wenn Stürme durch Zweige und Blätter saus'ten, Ast und Wipfel sich knirrend bewegten, blieb innerst doch der Kern des Herzens ungeregt. Was schüttelt dich nun? Was erschüttert den festen treuen Sinn? Ich fühl's, es ist der Klang der Mordaxt, die an meiner Wurzel nascht. Noch steh' ich aufrecht und ein innrer Schauer durchfährt mich. Ja, sie überwindet, die verrätherische Gewalt; sie untergräbt den festen hohen Stamm, und eh' die Rinde dorrt, stürzt krachend und zerschmetternd deine Krone. Warum denn jetzt, der du so oft gewalt'ge Sorgen gleich Seifenblasen dir vom Haupte weggewiesen, warum vermagst du nicht die Ahnung zu verscheuchen, die tausendfach in dir sich auf und nieder treibt? Seit wann begegnet der Tod dir fürchterlich? mit dessen wechselnden Bildern, wie mit den übrigen Gestalten der gewohnten Erde, du gelassen lebtest.

4. Ottokar von Böhmen, ein viel mächtigerer Fürst als der Graf von Habsburg, glaubte keineswegs dem neuen Kaiser gehorchen zu müssen. Dazu kam, dass die östreichischen Stände bittere Klagen gegen König Ottokar erhoben, wie er sie bedrücke und viele Ungerechtigkeit übe. Also liess Rudolph zuerst den König einladen, dass er auf dem Reichstage zu Nürnberg im Jahre 1274 erscheinen und von Rechtswegen den Lehneid leisten solle. Aber der König kam weder diesesmal, noch auf einem zweiten Tage zu Würzburg; und auf einen dritten zu Augsburg, im Jahre 1275, schickte er nur den Bischof Wernhard von Seckau als seinen Gesandten, und dieser war so dreist, vor den versammelten Fürsten eine lateinische Rede anzuheben, worin er beweisen wollte, dass Kaiser Rudolph's Wahl ungültig sei. Rudolph unterbrach ihn, und sprach: "Herr Bischof, wenn ihr etwas mit meinen Geistlichen abzumachen habt, so redet aller Dinge lateinisch, wenn's aber mich oder die Reichsrechte angeht, so redet deutsch, wie es der Brauch ist." Und die Fürsten, da sie inne wurden, der Bischof wolle Rudolph's Kaiserwahl antasten, enthielten sich kaum, dass sie ihn nicht zur Thüre hinaustrieben; aber der König verhinderte es und liess den Bischof am nächsten Tage von Augsburg abreisen.

Section II.—Grammar and Idioms.

(a.) Decline *derselbe*, *dieselbe*, *dasselbe*, and *wer*.

(b.) When does the superlative end in *sten* and has *am* before it? Give three examples.

(c.) Decline *das harte Schicksal—schwerer Stein*, *unser bestes Pferd*.

(d.) Put the definite article before the following substantives, and add the genitive singular and the nominative plural:—*Berg*, *Kenntniss*, *Braut*, *Thaler*, *Blatt*, *Loch*, *Maus*, *Hand*.

(e.) In what do separable compound verbs differ from the inseparable. Illustrate their differences by three examples.

(f.) State the second person singular, present and imperfect, both in the indicative and subjunctive of:—*Befehlen*, *bieten*, *ablassen*, *verstehen*, *nachgeben*, *vermögen*, *bedürfen*. Add also the participle past of each of these verbs.

(g.) Es ist gar nicht mit ihm auszukommen.
Das wird noch übel ablaufen.
Ich mache mir gar nichts daraus.
Es geht im Hause um.
Er hat sich umgebracht.
Reden Sie doch nicht so ins Blaue hinein.
Der hat das Pulver auch nicht erfunden.
Wer sich nur darauf verstände!
Setzen Sie mir das einmal auseinander.
Damit hat er mir einen Streich durch die Rechnung gemacht.
Er wird nimmermehr auf einen grünen Zweig kommen.

Section III.

Translate into German ten of the following passages. The writing, either in English, or German characters, must be very legible.

1. That is all the same to me.
2. I am going to buy three sorts of wine.
3. He arrived in town at half-past three in the morning.

4. They have been in this country these sixteen years.
5. They who are cruel cannot be good.
6. We who have long experience know more about it.
7. I should like to know what has become of them.
8. My brother is only eight years and a half old.
9. They have been obliged to leave town.
10. He had a new carriage made for him.
11. The judge ordered him to be whipped.
12. I have often been asked about the cause of it.
13. He ought to have been ashamed of himself.
14. The older he grows, the weaker he becomes.
15. We have heard her sing but once.
16. We received their answer but yesterday.
17. I insist upon your doing it directly.
18. Having left his house but ten minutes ago, he cannot have reached his office.
19. She is said to be a very clever writer.
20. It seems clear, that the wages of labour, estimated in money, were in 1685 not more than half of what they are now; and there were few articles important to the working man, of which the price was not in 1685 more than half of what it is now. Beer was undoubtedly much cheaper in that age than at present. Meat was also cheaper, but was still so dear that hundreds of thousands of families scarcely knew the taste of it. In the cost of wheat, there has been very little change. The average price of the quarter, during the last twelve years of Charles the Second, was fifty shillings. Bread, therefore, such as is now given to the inmates of a workhouse, was then seldom seen, even on the trencher of a yeoman or of a shopkeeper. The great majority of the nation lived almost entirely on rye, barley and oats.

Write in German a short essay on "The causes of strikes."

(*To be continued.*)

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BIRMINGHAM, 1865.

The business of the Sections commenced on Thursday, the 7th instant. The following is a list of the papers read:—

THURSDAY, SEPTEMBER 7TH.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

President's address.

Fleeming Jenkin—Report of the Electrical Standards Committee.

James E. Glaisher—Report on Luminous Meteors.

Professor Rankine—On the Second Law of Thermodynamics.

R. Sabine—On a New Method, introduced by Messrs. Siemens, of measuring Electrical Resistance.

W. Hooper—On India-rubber, as an Insulator for Telegraphic Conductors.

A. Claudet—On Moving Photographic Pictures.

H. C. Sorby—On a New Form of Spectrum Microscope.

SECTION B.—CHEMICAL SCIENCE.

Opening Address by the President.

H. C. Sorby—On a New Form of Spectrum Apparatus as applied to the Microscope.

F. A. Abel—Notes on Compounds of Copper and Phosphorus.

Dr. A. Voelcker—On the Composition of a Marine Boiler Deposit.

Dr. T. Phipson—On Silicium in Iron.

Dr. T. Phipson—On the Sublimed Oligist of Vesuvius and its Artificial Production.

Dr. T. Phipson—A few words on Sponges as a source of Bromine and of Nitrogen.

SECTION C.—GEOLOGY.

The President's Address.

Rev. W. S. Symonds—On some Ancient Drifts and Old River Beds of Siluria.

W. Pengelly—The Insulation of St. Michael's Mount.

Rev. W. Purton—The Geology of Colebrookdale.

G. Maw—On the Extensive Deposits of White Clays and Sands in North Wales—antecedent to the Boulder Clay Drift.

C. J. Woodward—On a Deposit near Lilleshall, Salop, containing recent Marine Shells.

Professor Harkness and H. Nicholson— Additional Observations on the Geology of the Lake Country.

SECTION D.—ZOOLOGY AND BOTANY.

J. Gwyn Jeffreys, F.R.S.—Report on Dredging in the Channel Islands. (Mollusca)

Rev. A. Merle Norman, A.M.—Report of the Committee appointed to investigate the Marine Fauna of the Channel Islands. Part II.

J. Gwyn Jeffreys, F.R.S.—Report on Dredging on the Coast of Aberdeen.

William Hinds, M.D.—On the Identity of Origin of Starch and Chlorophyll.

W. R. Hughes, F.L.S.—Notes on the Development of a Deep-Sea Sponge in a Marine Aquarium.

Rev. A. W. McKay—On the Turdus Migratorius.

H. T. Stainton, F.L.S.—On the extraordinary Partiality shown by insects of the Genus Laverna for Plants of the order Onagraceæ.

S. Moffat, M.D., F.G.S.—Phosphorescence in connection with Storms and Disease.

SUB-SECTION D.—PHYSIOLOGY.

The President's Address.

Dr. John Davy—On the Effects of Scanty and Deficient Food.

Dr. Lionel S. Beale—On Life.

Dr. John Hughes Bennett—Oh the Formation of Pus in Reference to the Fallacious Doctrine of Cell Pathology.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

Captain Wilson and Captain T. McNeil—Results of Surveys in Palestine.

G. Grove—On the Exploration of the Holy Land, as proposed by the Palestine Exploration Fund.

Colonel L. Pelly—Seychelle Islands.

S. W. Baker — Letters on the discovery of Albert Nyanza, from Mr. S. W. Baker to Sir R. I. Murchison.

Colonel L. Pelly—Comoro Islands.

D. A. Vámbéry—Origin of the Hungarians.

Colonel Phayre—Ethnology of the Hindu-Chinese Nations.

Colonel L. Pelly—Shores of the Persian Gulf.

Robert Swinhoe—Notes on Formosa.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

The President's Opening Address.

Thomas Avery—On the Municipal Expenditure of the Borough of Birmingham.

W. L. Sargant—On the Vital Statistics of Birmingham.

Reports on Local Industries (First Group):

George Heaton—Die Sinking.

J. P. Turner—Button Manufacture.

W. Bridges Adams—On the Division of Labour.

SECTION G.—MECHANICAL SCIENCE.

President's Address.

Sir W. G. Armstrong, C.B., F.R.S.—On Chain proving.

E. A. Cowper—On a new Cotton Gin for separating the fibre from the seed.

Thomas Levick—On machinery for compressing air, and the applicability of such compressed air for working coal-cutting and other underground machinery.

D. K. Clark—On Torbite (a new preparation of peat) and its uses.

R. W. Thomson—Description of a Rotary Steam Engine.

FRIDAY, SEPTEMBER 8.

Section A.—Mathematical and Physical Science.

Mr. Glaisher (Chairman of the Lunar Committee)—Report of the Committee.

Mr. Birt (Secretary of the Lunar Committee)—On the Progress of the Map of the Moon.

J. B. Capello and B. Stewart—On the Magnetic Storm of the beginning of August last, as recorded by the instruments at Kew and Lisbon.

Dr. Gladstone—On the Refraction Equivalent of Carbon.

Professor H. Smith—Report on the Theory of Numbers.

Professor Stevelly—On the Application of D'Alembert's Principle to the Rotation of a Rigid Mass.

Professor Price—On the Extension of Taylor's Theorem, by the Method of Derivations.

Professor T. A. Hirst—On Quadric Transformations.

Rev. R. Harley—On Differential Resolvents.

Mr. W. H. L. Russell—On the Calculation of the Potential of the Figure of the Earth.

Dr. Mansfield Ingleby—On a Method for discovering remainders in Arithmetical Division.

Oliver Byrne—On Dual Arithmetic.

Section B.—Chemical Science.

Dr. Angus Smith—On a Method of Estimating Carbonic Acid in the Air, with Apparatus.

Dr. Williamson—Report on the Analysis of the Gases evolved from the Bath Waters.

F. Crace Calvert—Notes on the Action of Acids on some Metals and Alloys.

Dr. J. E. de Vry—On the possibility of Manufacturing Neroli in the British Colonies.

Owen Rowland—On the Properties of Parkesine, and its Application to the Arts, Manufactures, and Telegraphy.

F. G. Finch—On the Utilisation of Blast Furnace Slags.

Dr. A. Voelcker—On recently discovered Phosphatic Deposits in North Wales.

Dr. Frankland—On the Constitution of the Acids of Acetic, Lactic, and Acrylic Series.

Section C.—Geology.

Henry Woodward—A description of a new Chart of Fossil Crustacea.

W. M. Williams—Some Vegetable Deposits in the Achensee—North Tyrol.

Geheimrath Von Dechen and Professor F. Römer—On the large Prussian Geological Map of the Rhenish Provinces and Westphalia.

First Report of the Committee for the exploration of Kent's Cavern.

Professor Harkness—On the Metamorphic Rocks and Serpentine Marbles of Connemara and Joyce's Country.

Professor Tennant—On the Agates found in England, with specimens from different countries.

Section D.—Zoology and Botany.

W. Lauder Lindsay, M.D.—On the Relations of the Southern to the Northern Flora of New Zealand.

George Humphry, M.D., F.R.S.—On the Homologies of the Lower Jaw and the Bones connecting it with the Skull in Ovipara.

W. F. Hiern—On Ranunculus radians *Revel* as a British Plant.

Dr. E. Perceval Wright—Notes on the Voracity of Chiasmodus, by Dr. Carte, F.L.S.

Rev. A. M. Norman, M.A.—On the Structure and Development of Salpa spinosa *Otto*, as observed at Guernsey.

Dr. E. Perceval Wright exhibited a Copy of the "Record of Zoological Literature for the Year 1864."

Dr. Jordan—An Examination of the British Lepidoptera, with a view to investigate the Origin of Species.

Sub-Section D.—Physiology.

Dr. Fleming—On the Prevalence of Tapeworm in Birmingham and its Causes.

Dr. Cobbold—Remarks on Specimens of Entozoa.

Dr. Cobbold—On Beef and Pork as Sources of Entozoa.

Professor Rolleston—Certain Points in the Anatomy of Lumbricus terrestris.

Dr. Davy—Is the Opinion that a diet of Animal Food conduces to Leanness well Founded on Facts?

Dr. Richard Norris—Rigor Mortis not Muscular Contraction.

Section E.—Geography and Ethnology.

Thomas Baines—Victoria Falls of the Zambesi.

J. Crawfurd, F.R.S.—Occidental or Western Negroes.

E. B. Tylor—Negro-European Dialects of the Negroes of Surinam and Curaçoa.

Dr. Cullen—Isthmus of Panama and Interoceanic Ship-canal Routes.

Dr. Cullen—Darien Indians.

R. Brown—Researches in Vancouver Island.

T. W. Farrar—Language and Ethnology.

Section F.—Economic Science and Statistics.

Reports on Local Industries (Second group):—

J. S. Wright—Jewellery and Gilt Toys.

Dr. Lloyd—Flint Glass.

Professor Leone Levi—Statistical Data in relation to the Representation of the People.

G. J. Johnson—Statistics of the Benefit Building and Freehold Land Societies of Birmingham.

Section G.—Mechanical Science.

Wm. Fairbairn, LL.D.—Report of the Gun-Cotton Committee.

Henry Bessemer—On the Manufacture of Cast Steel: its Progress and Employment as a Substitute for Wrought Iron.

Wm. Fairbairn, LL.D.—On some of the Causes of the Failure of Submarine Cables, and their Construction.

C. W. Siemens, F.R.S.—On the Sheathing of Deep-Sea Cables.

William Hooper—On India Rubber considered in reference to its Applicability as an Insulator for Telegraphic Conductors.

SATURDAY, SEPTEMBER 9.

Section A.—Mathematical and Physical Science.

Principal J. D. Forbes—On the Laws of the Conduction of Heat in Bars.

J. P. Gassiot—On the Change of Form and Colour which the Stratified Discharge assumes when a varied resistance is introduced in the circuit of an extended series of the Voltaic Battery.

F. Galton—On Spectacles for Divers, and on the Vision of Amphibious Animals.

Captain Selwyn—On some New Arrangement of the Poles in Magnets.

J. P. Harrison—On the Heat attained by the Moon under Solar Radiation.

Section B.—Chemical Science.

This Section did not meet on Saturday.

Section C.—Geology.

S. Bailey—The Economic Value of the various Measures of Coal and Ironstone in the South Staffordshire Coal Field.

H. Johnson—The extent and duration of the South Staffordshire Coal Field.

W. M. Williams—The Ancient Glaciers of the North and East of Llangollen, and more particularly in the Hope Mountain.

Principal Dawson—The Successive Palæozoic Floras in Eastern North America.

Rev. W. Fox—An Account of the New Saurian *Polacanthus* from the Wealden.

Rev. H. Housman—Fossil Footprints in the New Red Sandstone at Brewood, near Wolverhampton.

R. A. Peacock—On extensive and deep Sinkings of Lands in the Channel Islands Seas, and on some Changes of the French Coast of the Bay of Biscay within the Historical Period.

R. A. Peacock—On Steam as an active agent in Earthquakes.

D. Mackintosh—The relative extent of Atmospheric and Oceanic Denudation, with a particular reference to certain rocks and valleys in Yorkshire and Derbyshire.

Rev. A. M. McKay—The Red Sandstone of Nova Scotia.

J. E. Taylor—On Contortions in the Chalk at Withingham, near Norwich.

J. W. Salter—Explanation of a Map of the Faults in the Gold District of Dolgelly.

T. A. Readwin—On the recent Discovery of Gold at Gwynfynydd, North Wales.

SECTION D.—ZOOLOGY AND BOTANY.

This Section did not meet on Saturday.

SUB-SECTION D.—PHYSIOLOGY.

This Sub-Section did not meet on Saturday.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

J. Crawfurd—History of Cannibalism.

Dr. R. S. Charnock—Cannibalism in Europe.

J. Crawfurd—Papuan and Oriental Negroes.

Dr. Mueller—McIntyre's Journey across Australia, and Discovery of Traces of Leichhardt.

R. Dunn—On the influence of Civilization upon the Cerebral Development of the different Races of Men.

R. Swinhoe—On the Native inhabitants of Formosa.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

This Section did not meet on Saturday.

SECTION G.—MECHANICAL SCIENCE.

This Section did not meet on Saturday.

MONDAY, SEPTEMBER 11.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

James Glaisher—Report of the Balloon Committee.

G. J. Symons—Report on the Rainfall of the British Isles.

Dr. Gladstone—Interim Report of the Committee on the Transmission of Sound under Water.

F. W. Brearey—Remarks upon Aërial Navigation, suggested by Mr. Glaisher's late ascents.

A. F. Osler—On the Horary and Diurnal Variations in the Direction and Motion of the Air.

A. F. Osler—Suggestions respecting an Anemometer adapted for recording the Force of Hurricanes.

Professor Price—On some Applications of the Theory of Probabilities.

W. Symons—On an Improved Standard Barometer.

S. B. Howlett—On a Self-recording Anemometer.

SECTION B.—CHEMICAL SCIENCE.

Professor Wanklyn—Report on some of the Differences between the Normal and the Beta Alcohols.

Dr. D. S. Price—On the Action of Light upon Sulphide of Lead, and its bearing upon the Preservation of Paintings in Picture Galleries.

Report of the Committee on Gun Cotton.

Manning Prentice—The Progress of the Manufacture of Gun Cotton and its application to Mining, Military, and Sporting purposes.

W. L. Scott—On the Action of Alkali Metals on Gun Cotton.

W. L. Scott—On Arseniuretted and Antimoniuretted Hydrogens.

J. Smyth, Jun.—On an Apparatus for the determination of Ozone, and experiments made therewith.

Dr. De Vry—On the Rotatory Power of several Essential Oils.

Dr. Macadam—On Esparto Fibre, or Spanish Grass, and its employment in the Manufacture of Paper.

Dr. Macadam—On the Results of Agricultural Experiments made in 1864.

D. Forbes—On some Minerals from South America. On the Colour of Gold as seen by transmitted light.

T. Fairley—On the Reactions of Cyanogen. Note on Glycocine, with tables.

SECTION C.—GEOLOGY.

H. Hicks and J. W. Salter—Report on Further Researches in the Lingula Flags of South Wales.

D. Forbes—First Report on the Igneous Rocks of Staffordshire.

W. Molyneux—Further Report on the Distribution of the Organic Remains of the North Staffordshire Coal Field.

C. Twamley—On the Faults in the South Staffordshire Coal Field and their relation to the Igneous Rocks of the District.

W. Ness—On the Coal Measures in Mold Valley and their Products.

Rev. P. B. Brodie—On the Fossiliferous Beds of the New Red Sandstone (Upper and Lower Keuper) in Worcestershire.

Professor Harkness and H. Nicholson—On the Silurian Rocks of the Isle of Man.

H. Woodward—Description of a new Phyllopodous Crustacean from the Moffat Shales, Dumfriesshire.

E. Ray Lankester—On British Species of Cephalaspis and the Scotch Pteraspis.

Rev. La Touche—On the Nodules in the Limestone of Wenlock Edge.

SECTION D.—ZOOLOGY AND BOTANY.

Dr. Duncan—A description of Two New Species of Aporose Madreporaria, from Guernsey.

Dr. Scott—On the Occurrence of Orcynus alalonga on the Coast of Devon.

C. Spence Bate and Professor Westwood—On the genus Anceus (Anceus *Risso* and Praniza *Leach*).

E. Ray Lankester—Notes on Annelida from the Coast of Guernsey.

P. P. Carpenter—On the regard due to usage and utility, as well as mere priority in fixing Zoological Nomenclature.

F. Buckland—Report on the Culture of Oysters.

H. S. Ellis—To Exhibit some Tiles with young Oysters.

Dr. Mörck—On the Classification of the Mollusca.

Dr. Mörch—On the Zoological Affinities of the Mollusca.

Ed. Newton, M.A., a letter from, relating to a Remarkable Discovery of Bones of Didus in the Island of Rodriguez.

Rev. F. Hewlett—On the occurrence of the bones of extinct Struthious Birds in New Zealand in the same Oven with those of the Dog.

SUB-SECTION D.—PHYSIOLOGY.

Dr. B. W. Richardson—Report on Amyl Compounds.

Dr. George D. Gibb—Refutation of the view recently propounded that the food comes into contact with the vocal cords in deglutition.

William Turner—On Variability, as manifested in the construction of the human body.

Professor Rolleston—Certain points in the Anatomy of two Animals from the Mammoth Cave, Kentucky.

Section E.—Geography and Ethnology.

C. R. Markham—On a North Polar Expedition.

Admiral Ommanney—On North Polar Exploration.

T. Wright—On the true assignation of the Bronze Weapons, &c., supposed to indicate a Bronze Age in Western and Northern Europe.

D. Macintosh, F.G.S.—On the Comparative Anthropology of England and Wales.

J. Evans, F.R.S.—On the Worked Flints of Pressigny le Grand.

Dr. Charnock—On the Origin of the Gipsies.

Section F.—Economic Science and Statistics.

David Morris—On the past and present Productive Power of Cotton Machinery.

Mr. Edward Vivian, M.A.—On the admission of Illegitimate Children into Workhouses, as a means of preventing Infanticide.

Professor Rogers—On Patents and Copyright.

Section G.—Mechanical Science.

F. J. Bramwell—On Weldless Tyres, Circular Rolling and Railway Wheels.

S. N. F. Cox—On Siemens' Regenerative Gas Furnaces and Producers.

J. Robinson—On some Developments of, and Improvements in, Giffard's Injector.

George Fawcus—Suggestions for Improvements in Blocks for Lowering Ships' Boats: Improvements in Boats.

Cornelius Varley—On the Ventilation of Separate Rooms, and of Large Assemblies, and Coal Mines.

TUESDAY, SEPTEMBER 12.

Section A.—Mathematical and Physical Science.

Professor Plücker—On a New Method in Geometry.

Professor Sylvester—On a Peculiar Class of Questions in the Theory of Probabilities.

Professor Sylvester—On Professor Price's Modification of Arbogast's Method.

Professor A. H. Curtis—On certain Theorems in Laplace's Discussion of the Figure of the Earth and Precession and Nutation.

Professor T. A. Hirst—On Chasles' Method of Characteristics.

J. B. Capello—On the great Storm of December, 1864, on the Coast of the Peninsula.

J. Hartnup—On the Self-registering Barometer at the Liverpool Observatory.

T. L. Plant—On the Anomalies of our Climate.

D. Smith—On the Meteorology of Birmingham from 1853 to 1864.

L. Oertling—On the Hydrometer.

Captain Lendy—On the Topograph, a new Surveying Instrument.

Cornelius Varley—On an Instrument by which any Rainbow that is possible to appear within the area of any picture may be indicated in its right place and of the true size.

Section B.—Chemical Science.

T. Wood—On the New Formulæ with reference to Schools and Examinations.

Professor Maskelyne—On Crystallised Melaconite and Tenorite.

W. White exhibited Photographs of the Interior of the Great Pyramid taken with the Magnesium Light by Professor C. Piazzi Smyth, with notes thereon.

W. Willis—On the Aniline Process in Photography.

W. L. Scott—On the Formation of Ammonia from Nitrogen in the Atmoshpere.

W. L. Scott—On the Presence and Functions of Ammonia or its Homologues in the Blood.

J. C. Bowring—On the Preservation of the Sheathing of Ships, and Extraction of Silver from Sea Water, by means of Electricity.

J. C. Bowring—On the Direction of the Electric Current.

A. Hill—On the Sanitary and Economical Aspects of the Sewage question.

H. Bird—Observations on the Utilisation of Sewage, as conducted at Stroud, and on the Growth of the Sewage Plant.

Section C.—Geology.

Professor Phillips (President of the Association)—On Glacial Striation.

Dr. L. Adams and Professor Busk—First Report on the Exploration of the Maltese Caverns.

E. Whymper—A few notes on the Structure of the Matterhorn.

Prof. F. Römer—On a Fossil Spider from the Coal Measures of Upper Silesia.

Principal Dawson—On the Fossil Plants of the Post Pliocene deposits of Canada in connection with the climate of the period, and the Formation of Boulder Clay.

Rev. P. B. Brodie—Remarks on the Drift in part of Warwickshire, and on the evidence of Glacial action which it affords.

A. Startin—On the Drift in the parish of Exhall, north of Coventry.

J. G. Jeffreys—Notice of the occurrence of certain Fossil Shells in the sea-bed adjoining the Channel Islands.

C. Ketley—On the Silurian Rocks and Fossils of Dudley.

Dr. H. P. Holl—On the Pre-Cambrian Rocks of Central England.

Rev. P. B. Brodie—On a section of Lower Lias at Harbury, and on two new species of Corals in the Lias of Warwickshire.

E. C. H. Day—On the Lower Lias of Lyme Regis.

E. C. H. Day—On a Head of *Hybodus De la Bechei.*

E. C. H. Day—On the History of the Jurassic Seas, as evidenced by the History of the first Liassic Sea.

Professor Buckman—On the Oolite Sands of Dorset.

Mr. Pines—On the White Lias of Warwickshire.

Section D.—Zoology and Botany.

Dr. Crisp—On the Relative Weight of the Brain in relation to the intelligence in the Vertebrata.

W. R. Hughes—Exhibited Specimens of Lepidogaster bimaculatus and L. cornubiensis.

Dr. Sclater—On the birth of a young Hippopotamus in the Zoological Society's Gardens, Amsterdam.

C. Spence Bate—Report of the Committee appointed to explore the marine flora and fauna of the southern coasts of Devon and Cornwall.

Dr. Jordan—Exhibited an abnormal growth of a bud of a Birch Tree.

Thomas J. Moore—Remarks on some improved methods of displaying Birds in public Museums, illustrated by specimens from the Derby Museum, Liverpool.

Sir J. Lubbock, Bart.—On the Metamorphoses of Ephemera (Chlœon).

H. Woodward—Exhibited a chart of recent and fossil Crustacea.

Dr. Cleghorn—On the Deodar Forests of the Western Himalaya.

Dr. Mörck—On the Scope of Zoological Enquiries.

Dr. Prideaux—Phrenology, or the physiology of the brain, the most important department of Ethnology.

Sub-section D.—Physiology.

Dr. G. M. Humphry—Observations on a Female Skeleton, aged 104.

Samuel H. Parkes—On the early Development of Organs in Embryonic Life.

Dr. B. W. Richardson—Physiological Experiments with Ozone.

Dr. W. Dickenson—Functions of the Cerebellum.

Dr. Shettle—A few Remarks on the Causes of the Cattle Murrain.

SECTION E.—GEOGRAPHY AND ETHNOLOGY.

W. Chandless, M.A.—Ascent of the River Purus.

Dr. Vámbéry—City Life of Bukhara.

Sir H. Rawlinson—Notes on the Russian Frontiers in Central Asia.

C. Carter Blake—On certain Simious Skulls, with especial reference to a skull from Louth, in Ireland.

A. Adams Reilly—On a recent Survey of the Chain of Mont Blanc.

E. Whymper—On some new Expeditions in the Chain of Mont Blanc, including the Ascent of the Aiguille Verte.

G. S. Mathews—Ascent of Mont Blanc by the glacier de Brenva.

Colonel Pelly—On Arabia.

Rev. Dunbar J. Heath, M.A.—On the Antropoid and Mute Origin of the European Races, versus the theory of migration from an external source.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

Report of the Committee appointed to consider the question of uniformity of Weights and Measures.

F. P. Fellows—On the practical advantages of the Metric System of Weights and Measures.

James Yates—On Mural Standards for exhibiting the Measures of Lengths legalised in the United Kingdom.

Alfred Hill—Statistics of the Post office Savings Bank.

T. de Meschin, LL.D.—On the proposed Extension of Government Administration to Railways.

J. Thackray Bunce—Statistics of Crime in Birmingham, as compared with other large towns.

Reports on Local Industries—Papier Mâché, Steel Wire, Steel Pens, Crown and Sheet Glass, Brassfounding, Lighthouse Lamps and Reflectors, Iron Manufacture of Staffordshire, and Stained Glass.

SECTION G.—MECHANICAL SCIENCE.

Professor Rankine, LL.D., F.R.S.—Report of the Committee for experimenting on the difference between the resistance of water to floating and immersed bodies.

W. Fairbairn, LL.D., F.R.S.—On the strength of material considered in relation to the construction of Iron Ships.

E. A. Cowper—On the effect of Blowing Blast Furnaces with blasts of very high temperature.

J. M. Clements—On a Machine for stitching Button Holes.

Sir J. Burgoyne, K.C.B., F.R.S.—On Railways in War.

James Yates, F.R.S.—On Mural Decimal Standards.

George Burt—On a Pneumatic Hammer.

W. D. Grimshaw—On an Atmospheric Hammer.

William Sissons—On Steam Pile driving.

Owen Rowland—On Electric Torpedos.

Brooke Smith—On Warming, Lighting, and Ventilating the Birmingham Town Hall.

Nathaniel J. Holmes—On District Private Telegraphs.

WEDNESDAY, SEPTEMBER 13.

SECTION C.—GEOLOGY.

Rev. W. Holland—Remarks on the Geology of parts of the Sinaitic Peninsula.

D. Forbes—On the Existence of Gold-bearing Eruptive Rocks in South America, which have made their appearance at two very distinct Geological epochs.

G. Maw—On some Fossiliferous Slates occurring between the Bunter Sandstone and Mountain Limestone of the Vale of Clydd, North Wales.

W. S. Mitchell—On hitherto unrecorded Leaf Forms, &c., from Alum Bay, Isle of Wight.

G. R. Rumney—On a Coal Field in Brazil.

L. Percival—On a Recent Example of the Formation of Pyrites in a South Staffordshire Coal Pit.

G. E. Roberts—Notes on the Theory of Repulsion as Illustrative of Physical Geology.

Rev. W. Fox—On a New Wealden Saurian named *Polacanthus*.

H. Seeley—How England got her Tertiary Rocks.

H. Seeley—On the Upper Green Sand.

H. Seeley—On a Serpent-like Lizard from the Lower Chalk.

H. Seeley—On the Reptiles of the Cambridge Green Sand.

W. Von Haidinger—On the Progress of the Imperial Geological Institute of the Austrian Empire.

L. P. Capewell—Organic Remains of the Coal Measures.

SECTION D.—ZOOLOGY AND BOTANY.

Miss Irby and Miss Mackenzie—On the Characteristics of the South Sclavonic Race.

John Thrupp—On the Domestication of certain Animals in England between the 7th and 11th Centuries.

C. R. Markham—On the Arctic Highlanders.

Dr. Roe—On the Esquimaux.

Dr. Crisp—On the External Form of the Brain and Hand in the Orang.

Dr. Crisp—On the Food and Habits of the Mole, Sparrow, and Vespidæ.

E. J. Lowe—On the Propagation of Ferns by Means of Spores.

Dr. Hinds—On a Monstrosity of the Rose.

Rev. W. H. Sterling—On the Natives of Patagonia and Terra del Fuego. Some boys from Terra del Fuego were introduced to the Section.

SUB-SECTION D.—PHYSIOLOGY.

Dr. M. Foster—On Pericardial Fluid.

Prof. Macdonald—On the Parasitoid Type of the early Fœtal Development.

Dr. A. Gamgee—Note of Experiments confirmatory of those of Kühne on the non-existence of Ammonia in the Blood.

Dr. W. H. Lightbody—On the Vascular Arrangements of the Cornea.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

J. D. Goodman—Statistics of the Small-Arms Manufacture of Birmingham.

Rev. J. W. Bain—The Social, Moral, and Educational Status of the population of South Staffordshire.

Professor Bennett—Statistics of Pneumonia.

G. B. Galloway—Suggested Improvements applicable to the City of London, and other large towns, to improve Health and preserve Life.

G. B. Galloway—Means of Saving Life from Buildings which may be on Fire.

G. B. Galloway—Inter-communication between Railway Passengers.

J. T. Arlidge, M.B.—On the Duration of Life, the prevailing Diseases, and the Causes of Death of Potters.

Robert Wilkinson—A statistical review of the police-recognised drunkenness of the metropolis.

Henry C. Roper—The Physical and Geographical Features of the Country ten miles round Dudley, with remarks upon the natural drainage area as bearing upon the Sanitary Condition of the district.

TECHNICAL TRAINING OF ARTISANS.

The following account of the institutions for the technical training of artizans in France has been prepared by Mr. J. F. Iselin, from the documents collected by Mr.

T. Twining, in pursuance of the inquiry adverted to in the *Journal of the Society of Arts* for January 13, 1865:—

With a few special and important exceptions, which there will be occasion to notice further on, the whole of the technical instruction of France is under the immediate direction of the Minister of Agriculture, Commerce, and Public Works. Among the establishments which are directly under state supervision, are the Polytechnic School (*Ecole Polytechnique*), the School of Bridges and Roads (*Ecole Impériale des Ponts-et-Chaussées*), and the School of Mines (*Ecole Impériale des Mines*). These, however, are chiefly for the instruction of Government officials.

The Central Imperial School of Arts and Manufactures (*Ecole Centrale des Arts et Manufactures*), at Paris, was founded in 1829, as a private establishment, under the business direction of M. Lavallée, who was also its original capitalist. Dr. Lyon Playfair,* having visited it in 1852, speaks in the highest terms of this institution.

The only assistance which at that time it received from Government was in the form of an endowment for a certain number of exhibitions to educate students of humble means. The Councils-General of Departments occasionally grant a similar favour to deserving young men. As a commercial speculation, this school seems to have been singularly successful. That it has been highly appreciated by those for whose benefit it was established, will be seen by the following extract from a Report by the Budget Committee of the Chamber of Deputies:—

"You know, gentlemen, this useful establishment, founded in 1829 by the association of eminent professors, with the intention of forming civil engineers, the directors of works, the chiefs of workshops and factories. This private institution, which in its importance rivals in excellence our first public establishments, has created and put in practice a complete system of industrial education. It is at the same time a supplement to our Polytechnic School and an addition to our various schools of application. Such an institution ministers to one of the first necessities of the age, and therefore its success is complete. This is confirmed by the unanimous opinion of the first manufacturers of the country, and by the ease with which all the pupils educated at it have received employment."

The report here quoted was made shortly before Dr. Playfair's visit, when the school was attended by 300 students, all day pupils (*externes*), instructed by a staff of forty professors. The annual school fees amounted to £36. The courses of instruction were arranged to extend over three years,† "in the second year the practical operations being divided into two parts, the one general and the other applicable to one of the following four specialities,—mechanists, engineers, metallurgists, chemists."

In 1858 this school was given up to Government, and is now, like most other technical schools in France, under the direction of the Minister of Agriculture, Commerce, and Public Works, as above stated. The system and courses of instruction remain the same as under the former régime. The latter comprise Descriptive Geometry, Practical and Theoretical Mechanics, Analytical and Industrial Chemistry, Metallurgy, Mining, and Geology, as well as the direct and practical application of these sciences to the industrial arts. The classes are open to foreigners, and it is a remarkable proof of the estimation in which the school is held, that Belgium, Germany, Spain, and even England, not only send pupils there for the benefit of a technical education which they are unable to receive in their own country, but also show themselves anxious to obtain the services of other pupils of the establishment as managers of some of their most important manufactures. Indeed, General Morin and M. Tresca* complain that scarcely 50 per cent. of the students who have passed the school remain in France; the remainder obtain situations on foreign public works and railways.

Much, however, as is done by this school for the advancement of technical knowledge, it will be perceived that the advantages which it offers are confined to the higher classes of the technical community. It is in fact admirably adapted to provide the more scientific industries of the country with trained and able managers and masters; but it offers no corresponding benefits (nor is it intended to do so) to artisans engaged in handicraft trades.

CONSERVATOIRE OF ARTS AND TRADES (*Conservatoire des Arts et Métiers*.—This magnificent establishment owes its origin to the collection of machines, models, and philosophical instruments left to the French nation by the great mechanician, Vaucanson, in 1783, which became the nucleus of the present splendid museum. It will not here be necessary to give a description of these remarkable collections, already well known in England; it is desirable rather to call attention to the educational work undertaken by the institution. The royal ordonnance of 1819, creating four professorships in science—mechanics, physics, chemistry, and public economy applied to industry—first gave the Conservatoire an educational character, and since that time the addition of other professorships has still further increased its usefulness.† The present scheme of this institution is the instruction of the working classes in the principles of the sciences bearing on their trades and manufactures by means of lectures delivered by the professors. In addition, the large amphitheatre of the establishment is used for public lectures. When any discovery or invention is made, either in France or in foreign countries, of sufficient interest to arts, industry, or commerce, drawings or exact descriptions are obtained, deposited in the amphitheatre, and publicly explained. All new processes are likewise shown by practical and experienced workmen, under the direction of the several professors.

The following was the programme of free and gratuitous lectures for the years 1863 and 1864:—

Applied Geometry	Prof.	Baron C. Dupin.
Descriptive Geometry	,,	M. de la Gournerie.
Applied Mechanics	,,	M. Tresca.
Building Construction	,,	M. Trélat.
Physics	,,	M. E. Becquerel.
Applied Chemistry	,,	M. E. Peligot.
Chemical Manufactures	,,	M. Payen.
Agriculture	,,	M. Moll.
Agricultural Chemistry	,,	M. Boussingault.
Zoology	,,	M. Baudement.
Spinning and Weaving	,,	M. Alcan.
Printing and Dyeing	,,	M. Persoz.
Industrial Legislation	,,	M. Wolowski.
Industrial Economy and Statistics	,,	M. J. Burat.

It appears from the statements of General Morin and M. Tresca that the influence of this institution is, like that of the preceding one, rather confined to the higher industrial classes.

Not less important in their action in the progress of French industry, and by some even thought more beneficial, are the three Schools of Arts and Trades (*Ecoles Impériales des Arts-et-Métiers*), established at Châlons,

* Industrial Instruction on the Continent, being the Introductory Lecture delivered at the Government School of Mines for the Session 1852-53, by Lyon Playfair, C.B., F.R.S. (Longman, 1852).

† Dr. Playfair's Introductory Lecture.

* Rapports des membres de la Section Française du Jury International sur l'ensemble de l'Exposition. Classe xxix.—Méthodes et matériel de l'enseignement élémentaire. Section viii.—Enseignement industriel, par M. le Général Morin, membre de l'Institut, directeur du Conservatoire des Arts et Métiers, et M. Tresca, sous-directeur du Conservatoire des Arts et Métiers.

† Papers relating to proposals for establishing Colleges of Arts and Manufactures for the better instruction of the industrial classes, by Lt.-Col. J. A. Lloyd, F.R.S., F.G.S., Special Commissioner at the Exhibition of 1851.

Angers, and Aix, so situated as conveniently to embrace in their influence the whole extent of the country.

The following description is abridged from the prospectus issued by the Minister of Agriculture, Commerce, and Public Works:—

The Imperial Schools of Arts and Trades are designed to form foremen and heads of workshops (*chefs d'ateliers*), as well as skilful and well-informed workmen. The course of study extends over three years. The instruction is both theoretical and practical. The former comprises the French Grammar, Geography, Writing, Descriptive Geometry and Machine Drawing, Arithmetic and Book-keeping, Geometry, Algebra up to and inclusive of Quadratic Equations, Mechanics, and the Elements of Chemistry and Physics. The practical instruction is given in four workshops, and embraces forging and founding, working in wood and at the lathe, and the fitting both of machines and models. The works executed are of the same nature as those issued from any well-arranged factory, such as steam engines, machine-tools, and pumps, besides ironwork and hardware, and carpenters' and joiners' work.

In each school there is room for 300 pupils, some of whom are exhibitioners. All of them are boarders (*internes*), no day-scholars (*externes*) being received. They are admitted every year by competition at an examination held in the beginning of August before a local board (*jury spécial*) in each department. Every candidate for admission must be, at the time of his entering the school, between fifteen and seventeen years of age; be able to read fluently, to write a current hand, to spell, to work the first four rules of arithmetic, with vulgar and decimal fractions; have a knowledge of the elements of plane geometry and linear or ornamental drawing; and have completed an apprenticeship to some trade or handicraft analogous to those taught in the school. The admission is confined to natives of France; a foreigner is allowed to compete only under exceptional circumstances, and by special permission of the superior administration.

The fees for board and tuition amount to £24 (600f.) a year, and a sum of £8 (200f.) is required to be deposited by way of outfit before the pupil can enter the school. There is, however, a very liberal allotment of exhibitions, partly supported by the Government and by the departmental budgets, in addition to which, each school possesses 25 scholarships (*bons de dégrèvement*), reducing the school-fees by one-fourth, which are distributed to the pupils at the termination of the annual examination.

At the end of the third year, the students about to leave receive each a certificate of the marks they have obtained during their school course, and of the position they have held every half-year in their respective classes. No other diploma is given. At the same time the first fifteen of such students receive a silver medal, and can also claim, at the end of one year, a sum of £20 (500f.) to be used as a premium in establishing themselves in business. Another prize of £15 (375f.) is given to the best pupil in each workshop. Finally, to the three pupils among the above-mentioned fifteen most distinguished for progress in their studies and for good conduct, a sum of £100 (2,500f.) is distributed, being the interest of an endowment left to the schools by M. Jourdain, an eminent manufacturer. Thus nothing is wanting in the way of prizes to stimulate exertion and reward proficiency and good conduct.

The results attained are stated by the director of the school of Chalons to be most satisfactory. He more particularly claims attention for the geometrical drawing, in which he says his pupils exhibit remarkable ability. It rarely happens that three months elapse after a pupil leaves one of these schools, before he obtains advantageous employment.

It will be asked—what influence do these schools exercise on French industry? The answer may be given in the words of General Morin and M. Tresca:—"Every year they turn out and send into our factories three hundred young men, with mind and hand both formed. Some, and these are the majority, establish themselves as draughtsmen, and display great skill in fitting and arranging machinery, and in devising the most suitable forms. The remainder, after having wrought as workmen, attain quickly the position of foreman, and often are able to commence on their own account a manufactory of metal ware or a carpenter's shop. We are in a position to instance a large number of manufacturers of the first rank, who have received their education at the schools of arts and trades. Distinguished by their principals for their practical ability, they were promoted to the direction of important factories. Not less than a fifth of the number of members of the Society of Civil Engineers were formerly students at these schools."

It will be noticed that in these schools more attention is paid to the practical portion of technical instruction than in the institutions before described. The workshops, where the pupils are brought face to face with the details of manufacture, and in which they are compelled to take their share of manual labour, form a distinguishing feature and a valuable addition.

In founding an institution of this kind in England one of the desirable changes would be a still greater extension of its sphere of action in certain directions, especially as regards what may be called the domestic handicrafts; but far more important modifications would be required in order to open the enjoyment of its benefits to the generality of our working population. It must be borne in mind that in France the workmen's sons who constitute the majority of the candidates to the free schools in question are enabled, through the gratuitous educational facilities afforded to them, to give proof, in the examinations for admission, of a degree of knowledge which only the favoured few among our own rising industrial generation can at present command.*

Mining School (*Ecole des Mineurs*) at St. Etienne, and School for Master Miners (*Maître Mineurs*), at Alais.—These mining schools, the only French institution for special industrial training under government direction remaining to be noticed, are less numerously attended than the trade schools, but have an equal proportion of success. The purpose for which they were established is to render the same kind of assistance to the mining industry which the trade schools afford to manufactures. Both of them are under the management of the engineers of the Imperial Corps of Mines.

The two schools, however, have different objects in view. At St. Etienne the programme of the conditions of admission is very nearly the same as that for the Schools of Arts and Trades. The pupils are fitted to become viewers and captains of mines or directors of metallurgical works. Alais is intended to turn out master miners only, and the pupils on their admission are not submitted to an examination in either geometry or drawing. During their attendance at the schools they work in the mines on the footing of ordinary miners, and they are supposed to earn their maintenance and schooling.

In attempting to give a summary of what the French Government has done for technical education, and how far it meets the wants of the nation, we cannot do better than quote once more the able report of General Morin and M. Tresca:—"On reading merely the list of names of these" (government) "establishments devoted to industrial education, we can pronounce at once an opinion as to their extreme insufficiency. One hundred engineering diplomas are awarded every year by the minister to the students quitting the central school of arts and manufactures; three hundred leave annually the schools of arts and trades with certificates of their studies; and if we add two hundred young men to represent the free students of the school of bridges and roads and the

* Independently of the various free schools for children and adults, which in towns include instruction in drawing and elementary mathematics, and evening schools for art applied to technical industry, gratuitous scientific courses are delivered at communal expense by the professors of local colleges.

school of mines, those of the schools of St. Etienne and of Alais, and lastly, the few pupils who, after the completion of their studies in the Polytechnic and other special schools, sooner or later turn their attention to industrial pursuits, we arrive at a total (rather over-estimated than otherwise) of six hundred individuals to recruit annually the intelligent and more or less educated body which directs our French manufacturing industries. If we estimate the whole number of persons engaged in these industries at 1,200,000, we perceive that the above total represents very nearly one two-thousandth of the population of our works. Admitting that the mean duration of service be twenty-five years for the one number as for the other, it follows there will be one trained man over eighty operatives; one corporal to eighty privates—but a very small proportion of captains.

"If this army of workers were not stimulated by the necessity of supporting itself, it is evident that its staff would be absolutely incapable of guiding it; it finds its way almost by itself. Without guidance or rule of conduct it continues, regarding it as a whole, to do that which it has done before; it presents an inertia which individual exertions cannot overcome. A good system of industrial education, which opens out a new horizon to those who from their youth are devoted to an industrial career, would alone be capable of exercising on them an appreciable influence, but even then we must not look for an immediate result. The new generation will differ but little from its predecessor until the system of industrial instruction be made perfectly general.

"If, in place of forming a judgment on the results of our establishments for technical education as a whole, we examine their organisation in detail, we shall immediately perceive that each one has a different object in view; that they are perfectly independent one of the other; and that, founded under the influence of completely distinct ideas, they can in no way form an entire system to be compared with the organisation of the University education, of which what are called the liberal professions reap the exclusive advantage."

When an opinion as decided as this, on the insufficiency of the government establishments, is expressed by so good an authority, it is not surprising that many private efforts have been made in France for the same object. The results of these efforts will perhaps be examined at some future opportunity.

Fine Arts.

Statue of Dr. Jenner at Boulogne.—A statue of the famous English physician, Jenner, the introducer of vaccination, has been inaugurated at Boulogne. The sculptor of the statue is M. Eugène Paul. This is not the first monument that has been erected in France in honour of Dr. Jenner.

Exhibition of Water-Colour Drawings in Paris.—A remarkable exhibition of this kind is now open at the gallery situated on the Boulevard des Italiens, in Paris. M. E. Hildebrandt, a German artist, who enjoys a high reputation on the Continent, and who has travelled over the greater part of the world in pursuit of his art, exhibits no less than three hundred water-colour drawings. The differences which exist amongst the methods employed by English and foreign artists in the treatment of water colours, apart from the ability of the artist in question, render this exhibition especially worthy of the attention of English artists and amateurs.

Commerce.

Chinese Opium.—The Chinese prefer the Indian to the native drug. The native opium is, though very much cheaper, insipid, and very few of the Chinese smoke native opium unless it is mixed with the Indian. If they can get the Indian, of course, so much the better; but a Chinaman reduced to a state of poverty to which the state of opium smoking invariably leads, unable to purchase the Indian, mixes the native with the Indian, or even gathers up the cinders of Indian opium twice smoked and smokes them a third time. Native opium is sold for about 600 taels; while native Shensi opium is sold for about 400 taels. In 1862 native opium was offered in the market at 650 taels; this rise in the price of native opium was caused by political disturbances in Shensi, ultimately calmed down by means of bribes and donations, which threatened with extinction the whole trade of that province. The quantity of Indian opium imported into the Tientsin district depends entirely on the state of the Shensi crop. When the Shensi crop is deficient the demand for Indian opium increases, and *vice versa*. Of the Indian imports into Tientsin, 150 to 200 chests a month are purchased for consumption in the capital. What Pekin consumes of the native drug is not known, but the quantity must be large.

Supply of Cotton.—The following is from Messrs. Smith, Edwards, and Co.'s Circular for the 1st September:—"The prospects of our market still turn chiefly upon the supply of cotton to be expected from America, and considerable difference of opinion continues to exist upon that point; estimates, however, have a tendency to converge to a central point, and we should say that one million and a-half of bales of sound cotton as the total supply for the old stock and new crop is the favourite opinion among commercial men in America. There are some who consider one million or a million and a-quarter an adequate estimate, and a few still believe in two millions, but the great majority of competent authorities point in the direction we have stated. It is perfectly evident, however, that no certain data yet exist for forming a reliable opinion, and it is not unlikely that great changes of feeling will pass over the commercial mind before the end of the year. The progress of receipts at the ports will do much to influence estimates of the stock, and if, as seems likely, there is a period of large deliveries, we may expect a revival of larger estimates at least for a time. The receipts at New Orleans and Mobile have already reached a pretty large scale, say 30,000 bales weekly, and as the Northern consumption is only 10,000 to 12,000 bales per week at present, there is no reason why the surplus should not soon come to this country. There are now in the various American ports nearly 200,000 bales of cotton, and we think it probable that the shipments to this country will soon rise to 10,000 or 15,000 bales per week. There is, therefore, at last, the prospect of substantial relief to our spinners from the side of America, but from other quarters of the world the prospect is not hopeful. China still discontinues sending us cotton, and the supply at sea has almost run out; the importance of this fact may be estimated when we consider that she sent us 400,000 bales last year, averaging 240lbs. each, or equal to fully 200.000 bales of American cotton. Very little Bengal and Scinde cotton is also coming forward, and as we received some 300,000 bales of these kinds last year, a large diminution in them would leave a serious blank to fill up. Speaking generally, it appears likely that we shall receive a smaller supply of short-stapled Eastern cotton, at least to the extent of 250,000 bales of the size of American packages, as compared with what we got last year; and assuming that receipts from all other places continue the same, we would require to get 700,000 bales from America next year to give us a clear surplus of 250,000 bales over the receipts of 1864. This is evidently not a state of things that points to a permanent great decline in the price of cotton; and the period when full supplies of the raw material will be afforded to our manufacturing industry is obviously not yet within sight, and the stimulus of high prices will be required for years to achieve that result."

Colonies.

VINTAGE IN SOUTH AUSTRALIA.—The acreage now cultivated with vines in this colony is, 6,364 acres; during the past five years the area has doubled. Up to last season the proportion of bearing vines to those not yet productive was nearly equal; the present returns show 459,609 vines in bearing to 2,831,971 unproductive. Only a short period has to elapse before the whole of the extensive vineyards planted during the past few years will be in full bearing, so that the annual production will be annually augmented. Already the figures are high, for the vintage of the present season cannot be estimated at less than 1,000,000 gallons. That of last year was 798,647 gallons; that of 1863, 604,305 gallons. The home consumption is large, but it would be satisfactory to find a demand in a foreign market, which has not at present been the case, the exports of the year amounting to only 20,674 gallons, or 7,031 gallons less than in 1863.

LIVE STOCK IN SOUTH AUSTRALIA.—The live stock returns show an additional number of horses and sheep, but a large reduction in the number of cattle. Owing to the protracted drought in the far north it was difficult to make the returns. The number of horses is returned as 62,899, or 3,891 more than last year; 643 horses, valued at £10,996, were exported during the year. As showing the importance of this trade, it may be stated that during the past five years 3,224 horses have been shipped, chiefly to India, of a total declared value of £69,748. The total number of sheep depastured was 4,106,820, or 214,580 additional, showing an increase of 5 per cent. upon last year. During the twelve months 186,526 sheep were exported overland to the neighbouring colonies in excess of the imports, or 21,259 more than in 1863.

WATER SUPPLY IN VICTORIA.—A measure has been recently brought before the Colonial Parliament for supplying the country districts of the colony with water. For several years the metropolis and suburbs have had an abundant supply of good water from the Yan Yearn reservoir, which was constructed at a cost of £800,000 to £900,000, and is capable of containing 25,000,000 cubic yards of water. Little or nothing, however, has been done to extend similar advantages to other parts of the colony, which have experienced much inconvenience, and this has been more than usually felt during the past summer owing to the long drought. The annual rainfall is quite sufficient to furnish the colony with enough water for all purposes all the year round, but as the rain chiefly falls in winter months it is necessary to store it. Nature has afforded excellent facilities for storage, and the chief merit of the scheme submitted by the Minister of Mines is to turn these facilities to account by the construction of dams, reservoirs, and aqueducts. It is an extensive plan, embracing all parts of the colony except Gipps Land. Upwards of twenty distinct works are contemplated. The estimated cost of the whole work is about £1,200,000. As an example of the nature of the works and the quantity of water it is intended to store, and to be in a position to supply the different localities, the works contemplated for the town of Geelong may be instanced. The population of Geelong is about 25,000 inhabitants. The reservoirs to be constructed are to be capable of containing 1,000,000,000 gallons, the area of the watershed 11,000 acres, and the quantity to be supplied per diem is 1,000,000 gallons, the approximate cost of the works being £15,000. The largest work projected is the Cobban scheme, from the circumstance that the supply of water is principally obtained from that river. It will benefit a large mining and agricultural district, the population of which is 62,000. Reservoirs are to be constructed capable of containing 4,000,000,000 gallons, the area of the watershed being 64,000 acres. The quantity to be supplied per diem is 30,000,000 gallons. The estimated cost is £320,000.

Obituary.

J. G. APPOLD, F.R.S., died on the 31st August, at Clifton. Mr. Appold was well known among engineers and men of science for his great ingenuity as an amateur mechanician. His centrifugal pumps formed striking features of the Great Exhibitions, both in 1851 and 1862. He shared with Mr. Hawkshaw the credit of first suggesting the use of syphons for draining off the flood waters in the fen country, when the embankment there gave way some time ago, and, to a great extent, the paying-out apparatus used in laying submarine telegraphs was his contrivance. Some of the most remarkable proofs of his cleverness as an inventor, however, were collected in his own house and the works adjoining it. There everything that could be made so was automatic. The doors opened as you approached them, and closed after you had entered; water came unbidden into the basins; when the gas was lighted the shutters closed; a self-acting thermometer prevented the temperature rising or falling above or below certain fixed points; and the air supplied for ventilation was both washed to cool it and screened to cleanse it from blacks. Even the gates of his stableyard opened of themselves as he drove through, and closed again without slamming. Mr. Appold was a dresser of furs by a secret process, which he practised successfully for many years. He was elected a member of the Society of Arts in 1853, and took much interest in its proceedings.

Notes.

PUBLIC WORKS IN FRANCE.—It appears from officia returns that the great viaducts constructed on the lines of the French railways form a total of more than seven leagues in length. That of Meudon, which is about 150 yards long and 100 feet high, cost £22,400. The viaduct of Chaumont, on the Eastern line, cost £232,035; that of Mirville, on the Western Railway, £92,025; and that of Brunoy, Lyons line, £60,400. The tunnels are said to be more than 300 in number and to exceed 37 leagues in total length. The longest tunnel in France is that of La Nerthe, on the Lyons and Mediterranean Railway, near Marseilles, which cost £420,000; that of the Credo, between Lyons and Geneva, cost £260,000. The total cost of the whole of the viaducts, bridges, and tunnels on the French lines is given at £17,307,278. The new park of the Buttes Chaumont, mentioned in the *Journal* of the 4th inst., is proceeding rapidly towards completion. It is said that a million and a-half of trees and shrubs will be required for its plantation. In the same neighbourhood will be the new reservoirs for the supply of the higher parts of the city with water, and the new cattle market and general abattoirs. There are said to be 50,000 men, 6,000 horses, 20 locomotives, and 500 waggons now employed on these various undertakings. An important work, and one that has been long required, is now going on between the Rue Richelieu and the Rue St. Honoré, namely, the formation of a square in front of the Théâtre Français, three of the most miserable streets in Paris, the Rue du Rempart, the Rue Jeannisson, and the Rue Fontaine Molière, as well as a number of wretched houses in the Rue St. Honoré and the Rue Richelieu, will be wholly or partially swept away by this improvement. The Rue du Rempart stands on the site of one of the ancient ramparts of the city in front of which Joan of Arc was wounded in the thigh when besieging Paris. Two large new churches, one on the Boulevard Malesherbes, and the other at the end of the Chaussée d'Antin, are rapidly approaching completion, and another church is about to be commenced on the south side of the Seine, to be called Notre Dame des Champs. The cost of the last named is estimated at £180,000. Estimates are pro-

verbially elastic in France as well as elsewhere, and it is whispered that the new opera house, which was to cost about a million sterling, will absorb more than double, some say three times, that sum.

RAILWAY PASSENGER SIGNALS.—The French Minister of Commerce and Public Works recently issued a circular to the directors of all the railways in France on the subject of establishing signals for the security of travellers on railways, and it is said that, from the commencement of the coming year, all the carriages of every passenger train will be placed in communication with each other, and, consequently, with the conductors of the train. It is also said that mixed trains, to carry merchandise as well as travellers at reduced fares, are in contemplation.

CONSUMPTION OF RABBITS.—It is stated in a work of importance, the *Encyclopédie Pratique de l'Agriculture*, that the number of rabbits sent to the markets of Paris, which in 1845 only amounted to 177,000 heads, had risen in 1863 to two millions. Taking the consumption of Paris, according to the established rule, at one-thirtieth of that of the whole of France, the number of rabbits consumed must be set down at something like fifty-seven millions per annum. Official documents fix the average price of rabbits at rather more than two francs per head, so that the total value must be above four and a half millions sterling per annum, and that of the skins is set down at another quarter of a million.

Patents.

From Commissioners of Patents Journal, September 8th.

GRANTS OF PROVISIONAL PROTECTION.

Astronomical phenomena, illustrating—2139—J. L. Naish.
Axle boxes and bearings—2028—H. A. Bonneville.
Bedsteads, &c., sackings of—2036—H. Geering.
Bolt heading machines—2104—J. W. McDermott.
Bolts and nuts, screwing—2060—G. and A. Harvey.
Bottles, stopping—2150—J. B. Austin.
Bricks—2149—W. E. Newton.
Bricks and blocks—2068—J. W. Sumner and C. A. Scott.
Buttons—2146—C. Edkins, J. Newman, and T. Greaves.
Calf skins, &c., reducing the thickness of—2136—W. E. Gedge.
Capsules, metallic—2125—E. Rimmel.
China grass and flax, cleaning—2078—J. Faren.
China grass, &c., treating of—2114—J. Ingram and J. Culpan.
Cigarettes—2160—M. J. Lopez-y-Munoz.
Cigars—2032—A. V. Newton.
Colouring matters, preparation of—1947—P. A. F. Bobœuf.
Continuous motive power, self-generating—1973—J. J. Stoll.
Copper—2100—J. T. Lockey.
Cotton, sizing, drying, and beaming yarns of—2022—J. Gaukroger and J. Dodgeon.
Diseases of the stomach, &c., cure for—2123—O. Laurence.
Electrical signal apparatus, railway—2016—W. H. Preece.
Electric telegraph cables and wires—2161—C. Marsden.
Fibre, manufacture of straw of rye, &c., into—2171—E. H. C. Monckton.
Fire-arms—2050—W. C. Dodge.
Fire-arms, breech-loading—2030—T. W. Webley.
Fire-arms, breech-loading—2151—W. Soper.
Fire, extinguishing—2109—W. O. and J. Wilson.
Fluids, apparatus for preserving and discharging—2096—R. A. W. Westley.
Flying fish," a toy or game called—2145—G. Whitford.
Furnaces, steam boiler and other—2158—J. Lockwood.
Galvanic batteries for giving alarm of fire, constant—2144—J. S. Watson, A. Horwood, and C. Brumfit.
Gas burners—1968—F. Kup.
Gas burners—2994—H. Woodward.
Glass, ornamentation of—2038—J. H. Johnson.
Grass, &c., drying—1963—B. Latham and R. Campbell.
Guns—2014—H. D. P. Cunningham.
Hair, machinery for brushing—2058—S. Middleton.
Heating or evaporating—2072—T. F. Henley.
Hemp, &c., dyeing and preparing—2129—G. H. Smith.
Hollow articles in earth, &c., moulding—2084—R. W. Armstrong.
Hoops and tyres—1975—J. Ramsbottom.
Iron and steel wire or rods, furnace for annealing—2166—J. H. Scott.
Iron, plate or sheet—2012—E. Sabel.
Locks, burglar-proof—2092—W. E. Newton.
Lubricating compounds, preparing—2118—W. West.
Measurements, apparatus for taking—2112—W. Clark.
Musical instrument, keyed—2034—H. C. Baudet.
Packing cases or boxes—2141—J. Hope.
Paint and protective coating, composition suitable for—2163—J. G. Avery.
Paper bags—2116—J. H. Johnson.
Paper boards and pipes—2128—N. C. Szerelmey.
Paraffin and other oils, lamps for burning—2042—A. F. Osler.
Petroleum, &c., distillation of—2040—A. Millochau.
Pianofortes, &c., keys for—2156—D. G. and S. Staight.
Piers or erections, iron—1533—C. de Bergue.
Pomfret cakes, rolls, pipes, &c.—2143—W. and J. W. Wood.
Printing, lithographic and copper-plate—2170—D. McKellar.
Printing machines—2056—W. Rock.
Railway carriages and trains, retarding progress of—1954—W. King.
Railway carriages, to enable to pass from one compartment to another—2086—T. E. Stephens.
Railways and carriages, atmospheric—1987—A. Doull.
Railway trains, communicating and signalling between passengers, guards and drivers of—2052—H. Fletcher and G. Gore.
Revolving fire-arms, projectiles, and cartridges—2108—J. Broun.
Rollers or cylinders, covering for—2157—J. A. Turner.
Roof lamp-glasses, securing—2026—T. S. Raney.
Safes—2121—S. Phillips and J. Groves.
Sewing machines—2165—H. Willis and G. Rice.
Ships, cleansing and examination of bottoms of—2162—D. O. Jones.
Ships, loading and unloading of—2048—W. Clark.
Shop fronts, &c., construction of—2054—W. R. Corson.
Stair rods—2077—T. Allcock.
Steam engines—2062—H. Cartwright.
Steam, &c., regulating the passage or flow of—2043—A. A. Foubert.
Stench trap—2167—J. Newton.
Surfaces by photography, production of—2110—M. Henry.
Syphons—2168—L. J. Levisohn.
Telegraph cables—2155—F. Jenkin.
Terra cotta or vitreous stone—2071—M. H. Blanchard.
Threads, twisting—2147—R. A. Brooman.
Threads used in weaving, treating and printing—2083—R. A. Brooman.
Timber, grain, &c., drying—2127—A. V. Newton.
Type distributing and composing machines—2135—A. and W. Young.
Violet colours for dyeing and printing, production of—2070—L. Schad.
Waggons or trucks, lubricating the axles—2090—J. Knowles.
Walls, &c., ornamenting—2138—G. Howard.
Weaving, shuttles for—2122—A. Akeroyd and J. Lister.
Wick holders or burners for lamps—2024—E. Wild and W. Wessel.
Yarns, washing—2044—W. Pollock and J. Stobo.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Furnaces, steam blower for—2245—O. Bennett.
Water-closet apparatus—2270—S. Kettle.

PATENTS SEALED.

684. C. Johnson.	717. G. T. Bousfield.
695. J. Tann.	726. H. Chevob.
697. R. M. Roberts.	741. W. Brookes.
701. R. Marsden.	745. H. A. Bonneville.
702. H. Hill.	758. G. Ralston.
705. F. Wise.	763. F. Wise.
709. J. Deas.	772. J. T. and J. T. Cook.
710. G. Evans.	848. E. H. Smith.
711. R. A. Brooman.	859. J. Buckingham.
712. R. A. Brooman.	912. H. A. Bonneville.
714. E. D. Hodgson.	

From Commissioners of Patents Journal, September 12th.

PATENTS SEALED.

729. A. P. Price.	820. H. Oakes.
730. J. F. Brinjes.	832. W. Loeder.
738. W. Loeder.	917. J. Bathgate.
740. R. Bell.	953. J. Vaughan.
748. B. Lawrence.	955. W. E. Newton.
750. J. Bullough.	1031. W. E. Newton.
759. E. Pilling and J. Harper.	1050. W. E. Newton.
762. T. Kenyon.	1240. J. H. Johnson.
768. J. H. Kidd & J. C. Mather.	1592. J. Hayes.
797. H. Potter.	1858. S. Hingley.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2459. J. R. Johnson and J. A. Harrison.	2476. A. J. Alderman.
2461. J. Snider.	2481. W. Hirst.
2472. J. Hartshorn & W. Redgate.	2474. G. W. Belding.
2506. W. Richards.	2520. G. Bedson.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2014. J. Fielden.	2081. L. Vidie.
2069. L. Kaberry & T. Mitchell.	2175. J. Morrison.

Registered Designs.

Improved Back Guide—August 29—4738—John and Samuel Smith, Low Bridge Mill, Keighley, Yorkshire.
Bar of Soap—September 5—4739—Whitaker and Grossmith, 120, Fore-street, City-road.
Feeding Trough—September 11—4740—J. Dean, Woodstock.
Liquor Glass and Wine Glass—September 12—4741—Barrett and Mackenzie, Birmingham.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, SEPTEMBER 22, 1865. [No. 670. Vol. XIII.

TABLE OF CONTENTS.

Proceedings of the Society.

Musical Education Committee.

The following information, relating to the state of Musical Education in Italy, has been received through Her Majesty's Secretary of State for Foreign Affairs:—

ROYAL MUSICAL INSTITUTE OF FLORENCE.

The following is a translation of an account of this Institution kindly furnished by its President:—

The foundation of the Royal Musical Institute of Florence is recent. It was set on foot on the 15th March, 1860, and at the beginning of the year 1862 it was opened for public instruction. The Royal Institute is an establishment for public and gratuitous instruction in music. There are schools both for the rudiments of music and for musical reading, for solfeggio, for solo and part-singing, for keyed, stringed, and wind instruments; lastly, there are schools for thorough bass, for counterpoint, and for composition, and a school of æsthetics and musical history. Students of both sexes have thus an opportunity of obtaining in this Institute a complete musical education in every branch of the art; besides which, for the more advanced pupils, there are added periodical exercises in orchestral music, both instrumental and vocal.

The pupils do not reside in the Institution, but live in their own houses, and come to the Institution only tc receive instruction in the different schools, and totake part in the musical classes. The admission of pupils, and their removal from one class to another, depends on examination; and, previous to the grant of the diplomas, the pupils who have finished their course are subjected to a strict examination.

The Institute is under the direction and government of a president, assisted by three professors, who form what is called a Council of Management.

The Institute possesses a musical library, composed of selected music, and books relating to musical literature.

The Academy is composed of resident, corresponding, and honorary members.

The Examiners are chosen from the resident members of the Academy, as are also the three members of the council of management; these latter are elected triennially.

The number of pupils is not limited, being in practice regulated by the applications for admission, the result of the examinations, and the means available for imparting instruction. According to average experience, the number may be calculated at 220 pupils, one-third females and one-third males. Detailed particulars relating to the courses are given in the rules below.

The Institute has no endowment or property of its own, nor does it receive any payment from the pupils, who are gratuitously instructed. It is maintained by a grant from the state. The expenditure amounts annually to 40,694·70 lire,* of which 13,672·50 lire go to pay the management exclusive of the president and director, whose office is gratuitous, and the remaining 27,022·20 lire are for the instruction. The grant for apparatus is regulated by what is required; the average has been 14,300 lire. In this is not reckoned the rent of the place where the Institute is held, this being state property.

The following are the rules of the Royal Musical Institute at Florence:—

Chapter I.

The Institute is established to teach, singly and collectively, all the pupils of the Institute. It is intended that it should be opened periodically to all musical composers; that it should maintain a library of music for the use of the public, especially artists; that it should grant rewards to deserving artists; that the best works of modern and ancient masters should be performed there; that it should comprise a section for administration and direction; also one for instruction; and a musical academy.

At the head of the Institution is a president, a secretary, and a committee formed from the academy. There are sub-officers and others appointed by the president, and under the orders of the secretary, for the service of the Institute.

The musical academy is composed of resident and non-resident academicians, as well as a class of honorary academicians.

The Institution is in all respects a government one. It provides the musical service of the State on all public occasions, sacred and secular.

Chapter II.

The president has power over all the departments of his Institution. His office is permanent, but unpaid.

Section 2.

The secretary is responsible, under the president, for the financial administration. He receives the reports of the general conduct of the schools, and sees that the librarian and musical secretary perform their duties.

Section 3.—The Council.

The council is composed of three resident academi-

* Italian lire.

cians, appointed by the Minister of Public Instruction from amongst those who are not instructors in the academy. Their power is only corporate; they are elected triennially. There are also three supplementary councillors, in case of illness. The council is the judge in all examinations for admissions, &c. They receive an annual stipend.

Chapter III.—On Instruction.

Section 1.—*Schools or Classes.*

1. History of music and æsthetics as applied to music. This class has a master with the title of professor.

2. Harmony, counterpoint, and composition. A master with an assistant.

3. Accompaniment from a figured bass and from score. Has a master.

4. Singing, vocalisation, theatrical instruction, elocution, and deportment. Has a master and assistants when necessary.

5. Elementary instruction, reading music, and solfeggio. The pupils are instructed from the first principles to the practice of solfeggio. A master and assistants.

6. Organ, to enable the pupils to accompany the singing from notes. A master.

7. Pianoforte, for professional pianists. A master.

8. Secondary pianoforte, to enable singers to accompany themselves.

9. Violin and viola.

10. Violoncello.

11. Double bass. In this class the scholars are taught from the groundwork of their respective instruments up to the perfect execution for an orchestra or a quartet.

12. For wind instruments of wood.

13. For ditto of brass.

In these two classes the pupils are taught from the rudiments up to perfect orchestral execution.

21. A choral school is attached to the Institute, where the people can be instructed in choral singing. It does not form an integral part of the institution, nor is it a necessary step to the other schools. The instruction is gratuitous in this as in the other schools.

23. The instruction in both schools is gratuitous.

Section 2.—*Of Masters.*

24. The masters and sub-masters are all appointed by Government, on the recommendation of the president.

25. The masters are responsible for the good regulation of the classes to which they are attached, the arrangements of which have been settled by them with the president.

27. The masters and sub-masters must assist at the examination of their pupils.

28. The sub-masters and the assistants are chosen by the president from amongst the better pupils; their post is gratuitious, but if they have held it for a year they are usually paid something.

Section 3.—*Of the Pupils.*

29. The conditions on which the pupils are admitted are—Morality, good health, and natural aptitude. The age varies according to the nature of the instruction sought, but is never under nine years. Full knowledge of reading and writing and the elements of arithmetic are necessary. Special conditions for admission to each school are laid down in general rules. The pupils are admitted provisionally, and if they pass the examination are drafted into the Institute.

31. Fitness to pass from one class to another, or from one school to a superior one, is determined by the examination called "passaggio." After two failures a pupil is dismissed from the Academy.

32. To have the right to call themselves pupils of the Institute, it is necessary, at the completion of the studies, for the pupils to go through a final examination for a license; if this is well passed they are declared "Accredited Pupils of the Institute," and obtain their diploma. This gives them a preference, *ceteris paribus*, over others in competitions for any public employment.

33. The pupils must behave with respect both to their colleagues and their masters, to whom they must pay implicit obedience, and conform to all the rules of the establishment.

34. Flagrant and repeated faults amongst the pupils are punished by expulsion on the sentence of the president.

Section 4.

35. During the scholastic year such of the pupils as are considered competent practice concerted music. This practice is independent of the usual classes, and is as follows:—For bowed instruments and for quartett practice, under the direction of the violin master; for wind instruments, and for the execution of good harmony, under the alternate supervision of the masters of these schools; for the school of singing in concert with or without full orchestral accompaniment.

36. Public concerts by the pupils are given at stated periods and at the end of the academical year.

ROYAL CONSERVATOIRE OF MUSIC, MILAN.

The Vice-President writes as follows:—

In answer to your letter I send you the following notices, which I hope will be a complete reply to the dispatch of the Minister, dated 16th of February, 1865.

The Royal Conservatoire of Music at Milan is wholly maintained by the State.

The Conservatoire gives a complete musical education, and a fair literary education. The musical instruction is directed by 29 professors and by about 30 teachers, selected from amongst the best pupils of both sexes. For the literary branch there are seven professors. There are two other professors, one of deportment, pantomime, and ballet, the other for drill. There are, besides, a librarian and copyist, a tunist of the piano, a cashier and accountant, two inspectors, a secretary, seven inspectors for the pupils, four servants, a carpenter and decorator, a messenger, two porters. These persons (except the teachers of both sexes, who receive no payment for their services) cost the Government yearly 78,600 lire.

The Conservatoire instructs annually about 240 pupils of both sexes.

Each year the Conservatoire turns out from 12 to 15 finished pupils of both sexes.

To the pupils of both sexes who distinguished themselves the most at the yearly examinations is granted from year to year a monthly pension, arising from an endowment of 12,720 lire.

For all the other requirements of the establishment the State assigns 19,868·90 lire annually.

The fee which the pupils pay in each year is about 4,000 lire.

To this letter is added a copy of the rules of the Conservatoire, from which a more detailed account may be obtained, and to which is added statistics for the year 1862.

ROYAL COLLEGE OF MUSIC, NAPLES.

The Royal Neapolitan College of Music is composed of 100 pupils boarders at free cost (besides those who pay), and of the gratuitous day school with 120 scholars. In the holidays of the free boarders the free day pupils have the right to compete at the examinations with those who pay, and the director of music and four professors of composition and part-singing, and four other examiners chosen by the governor of the college, together with the said director, are the judges. The 100 pupils are divided into fifteen different classes, according to the following proportion:—

Class.	Pupils.
1. Composition, counterpoint, part-singing, and pianoforte	16
2. Singing	12
3. Violin	18
4. Viola	6

Class.	Pupils.
5. Flute	4
6. Fife	1
7. Hautbois	4
8. Clarionet	4
9. Fagotto	4
10. Horn	6
11. Trumpet	4
12. Trombone and ophicleide	4
13. English cornet	1
14. Violoncello	8
15. Double-bass	8

Two pupils, one from the violin class and one from the double-bass class, are instructed in the harp. The pupils who pay, have their choice of the classes, but not without considering in some degree the wants of the college.

The director of music has the superintendence of all that relates to the Art, and the musical instruction of the 100 free pupils and the instruction of those who pay is intrusted to 20 professors, divided into the following classes:—Two masters of counterpoint and composition, two masters of part-singing, two masters of singing, two masters of the pianoforte, two masters of the violin, two masters of the violoncello, one master of the double-bass, one master of the harp, one master of the clarionet, one master of the flute, one master of the oboe and English horn, one master of the horn, one master of the trumpet, trombone, and ophicleide.

Chamber practice is superintended by two other professors of music. The literary teaching of the pupils is entrusted to seven professors; one of ethics and logic; another of Italian literature and elocution; another of the French language; another of the Latin language, mythology, and universal history; another of the Italian language, geography, and history of their own country; another the elements of the Italian language; and the seventh, writing and arithmetic. Each year there are public trials to show the progress made by the pupils in their respective classes in composition, as well as in instrumental and vocal music; and also representations annually in the theatre of the Dramatic College, as examples for the School of Elocution; and in Passion week in the Church of St. Peter a Maiella the celebrated "Miserere" is sung by the resident as well as by the day pupils.

The musical lessons are given in three days of each week; on two other days there are vocal and instrumental concerts for the exercise of the pupils and the study of classical music in the library of the college. The musical instruction of the day pupils is entrusted to a fixed number of the resident pupils, with the title and rank of masters of the day school, and they are selected from the best scholars among the resident pupils. These masters give lessons three times a week; and at other times in the week the day scholars receive lessons from six professors of music with the title of inspectors. These are divided into one for singing, another for finger instruments, another for wind instruments, another for the violoncello and double bass, another for the violin, and the sixth for the conducting of concerts.

The revenue of the College is derived from two sources, one fixed and the other variable. The first consists of an annual payment from the state of 125,197 lire, of which 46,455·55 lire are paid directly from the Treasury to the masters and to others employed by the College; 55,000 lire paid in compensation for the rents of the College taken by the State; and a supplemental grant of 23,741·64 lire. The variable revenue consists of about 58,448·08 lire arising from the rents of the College, given by private persons for the foundation of four musical scholarships, abolished at different times, and since amalgamated into the present College, the rents varying according to the letting of the town and country properties.

The terms of paying pupils are—monthly 38·25 lire, and they find their own board, bed, and washing. The annual expenditure includes the maintenance of the boarders (who all receive from the College, board, clothing, washing, instruments, music, medicine, &c.); the day schools, the management, masters, teachers, servants, and repairs, &c.

The supreme government and administration of the College, in every branch, is confided to three governors, nominated by Royal decree, who give their services without any emolument whatever.

EXAMINATION PAPERS, 1865.

(*Continued from page* 669.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

ITALIAN.

THREE HOURS ALLOWED.

Candidates for a First-class Certificate are required to translate into English prose the following extracts, and answer the grammatical questions attached to them:—

I.

Non come fiamma che per forza è *spenta*,
Ma che per se medesma si *consume*,
Se n' andò in pace l'anima contenta.
A guisa d'un soave e chiaro lume,
Cui nutrimento a poco a poco manca,
Tenendo al fin il suo usato costume.
Pallida no; ma più che neve bianca,
Che senza vento in un bel colle fiocchi,
Parea posar, come persona stanca.
Quasi un dolce dormir ne' suoi begli occhi,
Sendo lo spirto già da lei diviso,
Era quel che morir chiaman gli sciocchi.
Morte bella parea nel suo bel viso.
(F. Petrarca, Trionfo della Morte.)

1. *Spenta:* Give the infinitive and the first person preterite of this participle.
2. *Consume:* This is a poetical licence for the sake of the rhyme. How should this word end according to grammar?
3. *Se n' andò:* What is the difference between this expression and simply *andò?*
4. *Parea:* Write the whole of present and the preterite tense, indicative mood, of this verb.
5. *Sendo:* What is the more common form of this word?

II.

Sveno, del re de' Dani unico figlio,
Gloria e sostegno alla cadente etade,
Esser tra quei bramò che, il tuo consiglio
Seguendo, han *cinto* per Gesù le spade:
Nè timor di fatica, o di periglio,
Nè vaghezza del regno, nè pietade
Del vecchio genitor, sì degno affetto
Intepidir nel generoso petto.
Lo spingeva un desio d'apprender l'arte
Della milizia faticosa e dura
Da te sì nobil mastro; e sentia in parte
Sdegno e vergogna di sua fama oscura,
Già di Rinaldo il nome in ogni parte
Con gloria udendo in verdi anni matura:
Ma più ch' altra cagione, il *mosse* il zelo
Non del terren, ma dell' onor del cielo.
(T. Tasso, La Gerusalemme.)

1. *Cinto:* Give the whole present and preterite tense, indicative mood, of this participle.
2. *Intepidir:* What part of the verb does this word stand for in this instance? How should it otherwise be written?
3. *Mosse:* Write the whole present tense, indicative mood, of this verb.

III.

Translate into Italian:—

After expressing his regret that I had not been able to

prolong my stay at Venice, my noble friend said, "At least, I think, you might spare a day or two to go with me to Arquà. I should like," he continued thoughtfully, "to visit that tomb with you;" then, breaking into his usual gay tone, "a pair of poetical pilgrims—eh, what say you?" That I should have declined this offer, and thus lost the opportunity of an excursion which would have been remembered as a bright dream through all my after-life, is a circumstance I never can think of without wonder and self-reproach. But the main design on which I had then set my mind of reaching Rome, and, if possible, Naples, within the limited period which circumstances allowed, rendered me far less alive than I ought to have been to the preciousness of the episode thus offered to me.

(T. MOORE's Life of Lord Byron.)

IV.

IDIOMATIC PHRASES.

(To be translated into English, not literally, but by equivalent expressions.)

Stetti in forse.
Se mi venisse il destro.
Non so trovare il verso.
Egli sparla d'ognuno.
Colgo quest' occasione.
Si fece avanti.
Parlatemi chiaro.
Cogliere il punto.
Che ve ne pare?
Se l'ebbe a male.

Candidates for a Second or Third-class Certificate are required to translate the following extract into English, and likewise to answer the grammatical questions given below:—

Proponendomi io di scrivere la storia delle cose succedute in Italia ai tempi nostri, non so quello, che gli uomini della presente età saran per dire di me. Conciossiachè mancati col finire del decimosesto secolo gli eccellenti Storici fiorentini, i quali soli forse fra gli Storici di tutti i tempi, e di tutte le nazioni scrissero senza studio di parti la verità, i tempi andarono sì fattamente peggiorandosi, e l'adulazione in guisa tale distendendosi, che il volere scrivere la storia con sincerità pare opera piuttosto incredibile, che maravigliosa. E non so perch' io m' oda dire tuttavia, che la storia è il lume del tempo, e che insegna bene il fatto loro ai popoli, ed ai principi: imperciocchè scritta secondo il costume, che prevalse, io non so quale altra cosa ella possa insegnare altrui, fuori che a dir le bugie; e qual buona guida nel malagevole cammino della nostra vita siano queste, ognun sel vede, stantechè i negozj umani con la realtà si governano: non con le chimere. E già i più tra coloro, ai quali io appalesai questo mio pensiero, mi dissero apertamente, o ch' io non oserei, o ch' io non potrei, od all' ultimo ch' io non dovrei mandarlo ad esecuzione. Pure, pare a me, che se l'adulazione si cerca da una parte, che certamente si cerca, molto ancora più si offra dall' altra, e che più ancora siano da accagionarsi di viltà gli scrittori, che di rigore, o di ambizione i principi.

(C. BOTTA, Storia d'Italia.)

GRAMMATICAL QUESTIONS.

1. Decline, with the definite articles in both numbers, the nouns *pianeta*, *re*, *azione*, *moglie*, *stuolo*, *colpa*.

2. Give two or three examples of an Italian noun substantive, with its augmentative and diminutive terminations.

3. Write the possessive, demonstrative, and relative pronouns in both genders and numbers, showing which of those pronouns take the definite article and which do not. Explain *when* the article should be omitted before such pronouns as otherwise require it.

4. Write the persons given of the following verbs of the regular conjugations:—They believe (*credere*); we were working (*lavorare*); you went away (*partire*); thou shalt feel (*sentire*); I would hope (*sperare*); let him lose (*perdere*); speak thou (*favellare*); fly not thou (*fuggire*); freed (*liberare*); following (*seguire*).

READING INDUSTRIAL EXHIBITION.

This Exhibition was opened on Wednesday, the 13th inst. The Bishop of Oxford opened the proceedings by a prayer. The Old Hundredth Psalm was then sung by the members of the Reading Philharmonic Society.

The MAYOR afterwards briefly stated the circumstances under which the design of forming such an exhibition was conceived and carried into effect, and invited the Bishop of Oxford to address the company.

The Bishop of OXFORD said—Mr. Mayor, my lords, and ladies and gentlemen, I have very readily responded to the call made on me to address a few words to you upon the interesting occasion of opening this exhibition. I believe it is calculated to be of real and abiding benefit to this town and the surrounding districts, in both of which I feel so deep an interest; and if, therefore, it is in my power in the slightest degree to help forward so good and useful an undertaking I hold that I ought—as I unfeignedly do—that I ought to rejoice to take any part whatever in its success. When I say that I believe this exhibition, and exhibitions such as this, tend to advance the interest of the town and neighbourhood in which they are opened, I do so for several different reasons. I think, in the first place that such exhibitions are of use to us fiscally as a nation—I believe that the history of almost all scientific discoveries teaches us the same thing. They have been very rarely reached by men, however gifted, however profound, sitting down and reasoning out the conclusions to which at last they have come. On the contrary, that which, in almost every instance, we call accident, because we have no better word to explain it—that development of events the connecting links of which are so swift that they escape the power of our mind to trace them—has mainly enabled us to arrive at almost every one of our great discoveries in applying science to the use of man. I am sure every one of you will remember the wonderful illustration of the truth of what I have just said in the discovery of that which alone has enabled the locomotive engine to run upon our railways, which have added so much to the prosperity of this town in which we are now assembled. The great difficulty in that case was to keep the fire burning which was to keep the water boiling which was to make the wheels move. Experiment after experiment was tried. The longest heads, the most practical ingenuity, set themselves to work to find how the thing was to be managed. Bellows were invented to blow the fire by which the wheels were to be turned in their gyrations. They, however, failed to effect the object in view, and I think for twenty years we were without the least improvement in elucidating the simple problem which we were endeavouring to solve; when, purely accidentally, the constructor of one of these engines, to save the trouble of two chimneys, made the chimney which carried away the smoke carry away the surplus steam, and thus the problem was solved. A vacuum was created, and the blast furnace for which man had been for years labouring was in a single instant flashed upon the intelligence of mankind. That I believe is the history of those discoveries throughout; and how does it apply? I think it means that when tinder is made there comes from the conflict a spark which, falling on that prepared tinder, enables you to get the light you may be long watching for in vain. Now, I maintain that such tinder is the mind of man, prepared to a great extent by such exhibitions as the present, and made ready for what we call the accidental opportunity to seize at once on that which it would never have understood if it had not undergone this process of preliminary teaching, and so by some sudden intuitive perception been able to grasp that which is offered to it, and to give to waiting mankind that which it had in vain endeavoured by a slower process to reach. I am of

opinion, therefore, that if throughout our towns the observing faculty is educated in that way among the great mass of the producing classes, the best possible results to a nation such as ours, in a fiscal point of view, will be produced. I also maintain that it is a very great thing in an intellectual point of view. I know it has been lately stated that a great man, Adam Smith, was mistaken in saying that there was a tendency, in setting men to purely mechanical work, to destroy the courage of their minds for discovery, the elasticity of their minds for general application, and the powers of their mind for general usefulness. For my own part I entirely believe in the truth of the doctrine which Adam Smith has laid down. If you get a mechanic to perform certain perfunctory acts, what do you do? You first set to work his fingers and all the mechanical instruments with which God has furnished his body. These you so practise that he comes to perform that one particular act with unerring accuracy and marvellous rapidity without any intellectual effort. What is the result? You have succeeded in making his hands unfit for any other work, save that to which you have limited altogether his endeavours, so that he will be a bungler at any other work which you call upon him to perform; you dwarf his general powers by concentrating their action on one minute act. The body is the tabernacle of the mind, and that which you have done for the man's body by so limiting his exertions you do for his mind too. If you accustom him to regard himself as a mere producer of one particular thing—the maker, for instance, of the head of a pin, or the fixer of the head of a pin upon the shaft—no doubt you may have succeeded in making him wonderful at that, but you have done it at the expense of cramping, first the elasticity of the body, and next the elasticity of the mental powers with which Providence has endowed him. Now this is all Adam Smith advances. He does not say you may not guard your mechanic against it, by teaching him at once to do that which he must do for the good of society perfectly, at the same time remembering that he is not a machine for doing that alone, but a man endowed by God's good will with all the mysterious attributes of humanity, and that you may maintain that humanity quick and lively by other exertions at other times, so as at once to produce the mechanical subtlety you want, and yet the marvellous framework of humanity unentangled in him by the mere accident of that particular labour. Now, then, I say such institutions as this are intended and calculated to do that very thing. They lead a man who might otherwise be chained down to his own particular work to aspire beyond it, to show us that he is a wheel in the mighty machinery that is now acting everywhere around him in such a land as this. You give him an opportunity of combining with the highest skill in his own peculiar function the opportunity of enlarging his faculties to the greatness of the common estimate with which you bring him into contact. Well, then, intellectually, I say it is for this reason of the greatest moment; and allow me to say that it is even of more moment in a moral sense, for I believe there is a great moral interest at stake in such a development of humanity as this. If, indeed, it were to stop with this, if it were to be nothing more than informing men's understandings, the education of their tastes, or creating in them appetites for something intellectually higher than that which they otherwise would have, I for one should be false to my dearest convictions if I did not say that education taken alone would be a failure; but I do say that, taken in its proper place, it is a great instrument in the moral elevation of humanity. The first great army of injuries against which humanity has to contend in its moral development consists of those which rest as the basis of their force on the passions, and on the sensible faculties of the bodily form in which the spirit tabernacles—the desires of the appetite, the love of drink, the mere bodily excitement to which those things minister—those, as we all know, stand first in the way of the true intellectual and higher moral education of the human family. Now, I believe, if you do give to your hardworking man opportunities like these of stirring up his intellectual faculties, teaching him—not by means of dry lectures, but by the practice of the day and by his own experience, that although he is an animal he is something vastly more than an animal; if you teach him that there is within him a divine spirit, a discerning taste, a mind reaching after many things, and that there is a pleasure in the gratification of those higher tastes which his Creator has endowed him with, which is greater than the pleasure, more enduring than the pleasure, more elevating than the pleasure which waits on any mere bodily excitement—I say that you have taken the very first step to raise that workman out of that which might have been to him corruption and a tomb. You have taught him to aspire to be indeed, in God's world, an intelligent creature, instead of being a mere enjoying animal. Those men who know as we do, that Christianity waits ever present to impregnate the prepared soil with the blessed seed of a yet higher teaching and of an eternal truth, must look upon such intellectual excitements as this as upon the teeth of the plough when it breaks up the hard ground, not that it can, like the sowing of the seed, yield the golden harvest, but that the breaking up of the ground must under ordinary circumstances as a rule be the preparation for sowing that higher seed which will be the prelude of the blessings of the intellectual harvest. Therefore it is that I believe that such exhibitions as this which we are opening this day are both intellectually and morally of great good to the people I see in them, too, many other elements of civilisation besides those upon which I have just ventured to touch. Everything which tends amongst us to break down in our own estimate of things the mere artificial distinctions of rank and place—and while they are preserved as God's appointment, and as essential, I believe, to the happiness of all prevents their so usurping all attention, and filling all eyes, that in the common estimate of men labour is considered as something degrading, and that people who have least of this world's good are in a measure lower than those who have the most—everything which guards against this evil I think such institutions as this may greatly help you to attain. For, after all, what are the greatest gifts that God gives? Are they not the natural gifts that God gives to any one of us? Are they not that marvellous faculty of genius that operates we know not how, but which does part one man from another, and is greater than any inheritance of outside things, which after all are little more than the dress he wears for a season, and casts off for ever in his hearse? Is not this imperishable gift of genius, the kindling of the fire which comes from the fire that is eternal, and which burns in the mind of the poorest amongst us, a gift greater than any of the external circumstances which belong not, indeed, to us, but are, as it were, the accidents—the play-clothes of the actors on the stage of life, while each plays his little part in the sight of man. I believe such institutions as this have a great tendency to develop the gift of genius. A man may have within him some of the great gifts of God, yet, unless there is something that brings out to his own knowledge first, and then to the knowledge of those around him, that they exist within him, they may sleep even through that man's life. We all remember, for instance, how a man has been remarkable for some great gift of genius; has, through his childhood, been struggling under difficulties because his schoolmaster could not understand that genius, and who, because God had not given him the attribute of learning without infinite toil and trouble ordinary matters, could not suppose that he was developing his genius, perhaps in portraying his somewhat tyrannical schoolmaster on the under side of some well-concealed desk under which he thought he would never look. It is perfectly certain that unless there is some mode of developing genius in the workaday world of ours, in many cases it never will become developed. The general spread of a certain kind of educa-

tion, unless we watch it, while it has a tendency to raise all to one practical level, has also a tendency to sink all to one practical level. It ignores altogether the recognition of the gift of genius; it stamps a perpetual repetition of the same coin with infallible accuracy from the same die, but it never can create genius. It never can give to the world men who are capable of shaping a statue such as Canova could chisel or such as Michael Angelo could design. Therefore with education such as it is now we more than ever want things which shall be, as it were, suggestive to minds in which genius may be slumbering, to call it into action and enable it to assert itself. A friend of mine the other day, travelling abroad, went to examine a famous school, and was shown over the whole of it. Its workings having been explained to him with the greatest minuteness, he found that provision was made for everything he could conceive; but there was nowhere, as far as he could see, the least allowance made for the exercise of any individual power, or any individual gift, in any one of the scholars, and he was turning away from the establishment with a very sad heart when his eye accidentally alighted on a slate put carefully aside, on which was an admirably-drawn picture of two schoolboys making horrible faces at one another. After having examined it he put it aside, exclaiming, "Thank God, this is a good school, after all." Now, I do not want these hideous faces; but I want beautiful repetitions of the finer works of nature, to act as suggestive instances, awakening in men's minds their higher energies, and reminding them that they possess powers which they never before suspected, so that they may be induced to imitate that painter who in the days of his youth said, on looking at one of the masterpieces of art, "I, too, am a painter." I believe that by spreading these works throughout the country we call forth the faculties of men by familiarising them with the highest works of genius; and I think we can see in it another good—it reveals man to man. A master who has under him in his manufactory one of these individuals in whom sleeps the seeds of genius, discovers through the medium of such an exhibition as this the hidden powers of humanity in his workman, and feels that a work has been done which he himself could never have compassed; immediately he looks upon this brother as indeed a brother, in a manner which he had never before appreciated, he sees in him, instead of a mere performer of some drudgery or some work for which he is to be paid, one in whom God has sown the seed of true humanity, and he begins to honour that humanity, so that the servant receives his due from his master, and the master himself is raised in the scale of creation by his acknowledgment of the gifts of Heaven in the man whom he employs. For all these reasons, then, believing that the welfare of this nation is indeed helped on by such institutions as these—believing that they tend intellectually to benefit those who produce for them and those who study in them—believing that they have also a moral effect on those connected with them—believing that the kindly interchange of human affections and mutual self-respect are encouraged and increased by such exhibitions, I do heartily rejoice that this one has been opened among us. I rejoice first for those whom I see in that gallery opposite, who have contributed such striking works of industry to this exhibition. This is to them, I think, a day of lawful triumph—a day of real intellectual rejoicing. They come and see the work which they have been enabled to accomplish; they see it in its beauty, and they look—as I know men often look—with wonder at the work of their own hands, as they ask themselves how they were ever able to conceive that which they have executed. I rejoice in this event too for the sake of the great mass of this district. I rejoice in it further because it has afforded an opportunity to those upon whom God has bestowed wealth and station of contributing to the good of their neighbours. I rejoice to find the names, the honoured names, of almost all those who occupy the highest position in this county vying with each other in this true work of common kindness and usefulness. I rejoice—and I know that this whole meeting will sympathise with me in that joy—that that conduct has been approved, and that the example of it has been set by our beloved Queen. In this Royal county we rejoice in this Royal countenance. We rejoice in it, not as those who merely wait upon the great, but as those who see in the ancient throne of this ancient kingdom the impersonation of its own greatness, and the instrument whereby God has preserved its liberties. I for one feel that our gracious Queen, in making these loans to this exhibition, was not merely fulfilling the dictates of a drier, colder, and harder judgment, but that her affections ministered too to the same result. Does any one in this place who has known the natural touch of grief think that upon this occasion she forgot to whom Britain owed its first Great Exhibition—whose thoughtful mind forecast those benefits of which I have feebly spoken—whose unfailing energy carried that first attempt to a successful issue—whose loving care for his wife's people made him face anything by which he could benefit them in any way? No: she who was even then, piously, in memory of the dead, unveiling that memorial statue, felt that she was ministering to the like remembrance when she lent the treasures of Windsor Castle to this industrial exhibition at Reading. She felt that she was doing that which he would have done, and which he would have her do; and, doubtless, with the joy of benefiting you was associated the remembrance, the blessed remembrance, of that great and good prince—for, alas! it is now no flattery to speak of him as he was; and I may venture to say, as one who knew him with even an unusual intimacy, that he was one whom I never found surpassed in intellectual capacity—whose mind seemed to me to be capable of being applied with equal facility to every kind of study—who forgot nothing that he had learned—who classified in his philosophical and capacious mind all the multitude of things which his eager thirst for knowledge unsparingly supplied to him, and who ruled all under the most unbending law of what he believed to be his duty, consulting from morning till night, as best he could, the interests of the people by whose throne he had been, by God's providence, placed. Yes, it is to me a joy to think that the noble lady in ministering to our benefit could honour that immortal memory; and following her, as I have said, the possessors of treasures in this county have lent them most freely to us. It is for you, my friends, now to make the best use of them, not to gaze on them with that mere empty stare which conveys little to the mind; but, whatever may be your special sphere, to study the model set before you here in that sphere, to ask yourselves why such a work is good; what is the reason that it affects you; wherein should you have failed if you had attempted to do the like;—and so patiently and humbly to take as your model that which is here presented to you, aiming in all this to do your duty in the state of life to which God has called you—to develop more perfectly the instruments of service with which he has endowed you, and in the midst of a redeemed world to work as renewed men, educating yourselves for service here, and for the blessed visions of the Almighty hereafter.

The "Hallelujah Chorus" was here sung by the volunteer choir. The Earl of Abingdon then moved a vote of thanks to the Bishop of Oxford for his attendance upon that occasion and for the delivery of his impressive address. Colonel Loyd Lindsay seconded the motion, which was at once carried by acclamation. The Bishop of Oxford acknowledged the compliment, and then, at the request of the Mayor, declared the exhibition to be open.

A vote of thanks to the Mayor for his services in promoting the exhibition was proposed by Mr. Benyon, and seconded by Sir F. Goldsmid.

The Mayor returned thanks for the honour which had thus been conferred upon him; the "National Anthem" was sung; and the ceremony of the opening of the exhibition was brought to a conclusion.

BRISTOL WORKING MEN'S INDUSTRIAL EXHIBITION.

On Tuesday, the 19th instant, the Working Men's Industrial Exhibition, in the Great Drill-hall of the 1st Gloucestershire (Bristol) Volunteer Corps, in connection with Bristol, Bath, the West of England counties, and South Wales, was opened with much ceremony by the mayor and civic authorities, the bishop, dean, and clergy, and numbers of the resident and neighbouring gentry attending. The Exhibition comprises specimens of handicraft in almost every department of industry, numerous specimens of sculpture and carving, models of steam engines and other machinery, specimens of needlework, and there is in connection with it a gallery of pictures. It had been intended by Lord Palmerston to open it, but his lordship's indisposition prevented his doing so, and Mr. Gladstone and Lord Stanley, who were invited at a late hour to accept the vacant honour, being both pre-engaged, the distinction was proffered to and accepted by the chief magistrate of Bristol, Mr. W. Naish.

Prior to the ceremony there was a procession of the different trades and benefit societies, which at the council house was formed by the Mayor, in state, the high sheriff, Mr. Cruger Miles, and other dignitaries.

As soon as the procession entered the building the bands of the volunteer corps conjoined struck up the National Anthem.

The Mayor then addressed the assembly, and formally opened the Exhibition. The Bishop of Gloucester and Bristol then offered up an appropriate prayer, after which the choir sang Handel's "Hallelujah" chorus from the *Messiah*, and the proceedings closed with singing the National Anthem.

COLONISATION; ITS ASPECTS AND RESULTS.

By William Stone, Esq.

(*Continued from page* 628.)

Literature and Science.

The important influence which our colonies exert upon the production and sale of books will be evident to every one devoting a short time to the examination of the matter from whichever point of view we regard it, whether as the scene of their subject, or as the market for their sale.

Writers of some of our most interesting books of travels and important scientific works on botany, geology, and natural history, have found their subjects in our colonies, and writers of fiction and poetry have laid some of their most exciting scenes in the adventurous period of colonial discovery, or in the piquant treatment of circumstances suggested by events in their history. Not only have home writers and men of science been largely influenced and benefited by colonial subjects, but able men who have received their scientific training in England are to be found permanently located in every colony, and either by original treatises published on the spot, or by their valuable contributions to English literary and scientific works, greatly promote the sum of human knowledge. Notice must also be made of the meteorological, astronomical, and magnetic observations, which are constantly being carried on in so many of our colonies, essentially contributing to advance our acquaintance with the phenomena of nature.

Some interesting points of practical science in connection with our dependencies and colonial possessions, and to which we can only make the briefest allusion, have reference to the attempts at acclimatization and the introduction of various animals and vegetables into new regions. Millions of sheep, goats, cattle, pigs, horses, and poultry overrun the continent of Australia and the island of New Zealand, in the latter of which no four-footed animal except a rat was previously known to exist.

One of the most curious and exciting chapters of adventures is the tale of Governor Bligh, whose crew, while prosecuting the purpose of introducing the bread fruit tree from Tahiti into the West Indies, mutinied, and he himself with eighteen others were cast adrift in an open boat, 23 ft. long, 6 ft. 9in. wide, 2 ft. 9 in. deep, and reached Timor forty-one days after leaving the ship, having run 3,618 miles, and notwithstanding their extreme distress, no one perished in the voyage. The mutineers of the *Bounty* subsequently formed that curious, anomalous and peculiar community known as the Pitcairn Islanders, who have been recently removed to Norfolk Island, owing to the increase of their numbers outgrowing the capacity of the former place.

The successful exertions of Mr. Ledger to convey the alpaca from South America to New Holland, and the praiseworthy attempts to render us independent of South America for quinine, by the cultivation of the cinchona plant in India, deserve a more extended notice than our space will allow of being given. And we may further add that in many of the colonies zealous exertions are being made to encourage and protect our English game and other birds, and while we are discussing the propriety of abolishing or modifying our game laws, they fear that unless some protection is afforded the game will be almost entirely shot off, as is the case in the more settled districts of the United States of America, laying some stress on the fact that while in some countries game, as in the pleasant land of France, is scarce or unobtainable, the English preservers of game secure an abundance of sport but not a monopoly of the produce, which is sent to market, and thus all persons are enabled more or less to secure the gratification of partaking of game food at a not immoderate price, certainly at a much less cost than the actual preservers incur for what they consume. These observations are susceptible of numerous other illustrations, from both the animal and vegetable kingdoms, if space permitted, thus we have the sustaining power of the world greatly increased by this largely-extended cultivation of food, man's health improved by the enlargement of his medical resources, and even luxuries rendered available and abundant.

While some of the sons of colonists receive a liberal education from men of learning who have departed from English shores, others resort to the English universities and colleges of law and medicine to prosecute their studies, and return with English honours to take a high position amongst their fellow-colonists.

Some of the colonies have successfully started literary works of humour, as the Melbourne *Punch*, many of the articles in which would not at all disgrace its Fleet-street contemporary, as, for instance, the pieces entitled "A Colonial Christmas Ode," by a Saturnine New Chum, and "Enoch Arden boiled down," which space and the purpose of these remarks will not allow of being introduced.

English books are not more eagerly sought for by the most rapacious home reader, than by colonists spread far and wide over the whole earth, who, having leisure and sufficient means, annually obtain from the English market immense numbers of all kinds of books, not only of light and cheap literature, but also the more expensive works of reference. In my own case I may say that some of the most pleasant acquaintances with English standard works I ever made, were by my solitary readings in a New Zealand hut, with no civilised companion than the thoughtful dead.

A touching illustration of the tenacity with which, under the most unlikely and painful circumstances, readers will cling to an old and pet volume, we have in the fact that one of the few rescued remains of the Franklin expedition was a torn fragment of the "Vicar of Wakefield." How the genial soul of Goldsmith would have gladdened at the thought that his simple pathetic tale would solace the last sorrows of such heroes. Re-acting upon our national writers is this influence of a world-wide audience. Magazines, newspapers, periodicals of all kinds, speed on their way by sail and steam to every nook of the world; from the depths of the backwoods of Canada to the most

recessed sheep station in Australia, open eyes, minds, and hearts lovingly wait the arrival of the mail bringing from home its choicest words of mirth and wisdom.

Fine Arts.

FOREIGN EXHIBITIONS.—The section of Fine Arts of the Cercle Artistique, Littéraire, et Scientifique, of Antwerp announces the foundation of an annual exhibition of the works of Belgian and foreign artists. The exhibition is to take place in a gallery erected for such purposes in the establishment of the Cercle itself, and the direction is entrusted to a committee composed exclusively of artists, amongst whom are Baron H. Leys, Comte Dubois, and MM. Bource, Dauriac, de Keyser, de Brackleer, Lamorinière, Tadema, Van Hove, and Verlat. A lottery is to take place in connection with the exhibition, and the prizes are to be purchased from the works of artists whose names are to be drawn by lot from the list of members, and of associates paying ten francs a year to the association. The first exhibition is to take place this year, but the date is not yet announced.—Exhibitions of the products of industry and works of art are to take place next year, almost simultaneously, at Copenhagen and Stockholm. A commission, with Prince Oscar of Sweden at its head, decided some time since that such an exhibition of Scandinavian productions should be opened at Stockholm on the 15th of June; a short time afterwards a commission was formed at Copenhagen, under the presidency of the Prince Royal of Denmark, and it decided on a like exhibition, to be opened on the 1st of the same month. The artists and manufactures of Copenhagen, naturally considering the coincidence of the two exhibitions unfortunate, suggested the adjournment of the latter to the year 1868. A correspondence was opened between the two commissions on the subject, but no very satisfactory result has been arrived at. The Copenhagen exhibition is to be opened on the 1st of May, and closed 1st of July, while that of Stockholm is to open on the 15th of June, as originally proposed, but Danish contributions are to be received until the 15th of July, and the reports of the jurors are to be deferred, in order that what is sent from Denmark may be included.

Manufactures.

CHINA GRASS.—The experiments which have been made in France with this fibre, and which have been duly recorded in this *Journal*, are being followed up by the necessary steps to carry the matter into practical operation. A company is announced as having been formed for the preparation, combing, and cottonisation of China grass. The capital of the company is 3,000,000 francs, to be raised in shares of 500 francs each; and amongst the ten members of the Administrative Council are the Maire of Rouen, the President of the Tribunal of Commerce of that place, four other members of the Chamber of Commerce of the City, of the General Council of the Department, or of both, and three are members of the Administration of the Bank of France. The composition of the new company proves that the expectations raised respecting the economic application of this well-known but little-used fibre are entertained by practical men.

AILANTHUS SILK-WORM.—The long continuance of warm weather has greatly favoured the experiments made in the rearing of the *Bombyx cynthia*. In the enclosure within the Jardin d'Acclimatation, in the Bois de Boulogne, may be seen at the present moment a large number of these worms of the third generation of this season, feeding in the open air on the ailanthus, or spinning their cocoons. The creatures are of great size, and seem to be in perfectly healthy condition. The cocoons are generally formed at the extreme end of the branches, or rather of the leaves, for the ailanthus has long compound leaves, with many leaflets, like the ash, where no bird, however light, could rest and make a meal of the occupant, and the worms take the curious precaution, before commencing the cocoon, to attach several threads of their web to the leaf-stalk as high as the third or fourth leaflet, so that if that on which the cocoon is fixed were to be broken from its stalk, it would still be held pendant by these stay-threads.

Commerce.

SUPPLY OF SUGAR.—The following is from Messrs. William Connal and Co.'s circular:—"In forecasting the future of the market for the next two months, there is every probability that the imports will fall far short of those of 1864, when the burden of supply was thrown on the autumn, instead of being distributed, as usual, over the spring and summer; and though a comparison may be more fairly made with the supply for the corresponding period of 1863, it may be materially modified by the revival which has now taken place in the American demand, and which already has raised prices in Cuba about 2s. above those ruling here. The import of 1864 for September and October, amounting to above 110,000 tons, exceeded that of 1863 by 63,000 tons, so that, with our increasing consumption, the stocks on 31st October in the United Kingdom will show a material decrease. Present duty paid prices are about 1s. 6d. lower than in 1863, and 6s. lower than in 1864. The only element to check the market is the yield of the Continental beet-root crop, which in the meantime is not estimated as likely to be greater than that of last year."

THE COFFEE TRADE.—The gradual decrease in the consumption of coffee, usually attributed to the increased consumption of tea, appears to be a most serious matter for the coffee-growers, whose whole prosperity depends upon this particular branch of commerce. The Planters' Association in Ceylon have forwarded a petition to the Chancellor of the Exchequer, that of late years the consumption of coffee has been steadily declining, the deliveries for 1864 showing a falling off of more than 12,000 cwt., as compared with 1863, and of nearly 28,000 cwt. as compared with 1862; while the consumption of tea, on the other hand, has been rapidly on the rise, the deliveries for 1864 showing an increase of about 3,500,000 lbs. over 1863, and nearly 10,000,000 lbs. over 1862. The petitioners urge that this contrast is owing in great measure to the reduction of 5d. per lb. in the duty on tea effected in 1863. They fear that the late further reduction of 6d. per lb. will render the contrast even more striking, and their fears are justified by the fact that, in the first five months of this year, 1865, the deliveries of coffee for home consumption were upwards of 20,000 cwt. less than in the corresponding five months of last year. They point out that, whereas the present duty on tea of 6d. per lb. may be taken as 17 per cent. of the value of the produce, the duty on coffee at 3d. per lb. is above 35 per cent. of its value, and finally, to prevent a further aggravation of these results, and to place coffee in a position to compete on even terms in the home market with tea, the petitioners "pray that in the coming year a reduction may be proposed in the duty on coffee proportionate to that already carried with regard to tea." Messrs. Travers observe that "it is not impossible after all that the loss of trade in the home market may be more than made up by an increased demand on the Continent. At Hamburg, the greatest coffee market in Europe, from which the supplies for the interior of Germany and the countries to the north are derived, the demand is constantly increasing, and the prices have been rising for some years past. This, we believe, is the case all over the Continent. To meet this increased demand,

the cultivation is everywhere spreading, and especially in our possessions in India and Ceylon. In some minor places, however, as, for instance, in Borneo and Réunion, the cultivation of the plant has been much neglected, whilst in other parts its introduction is looked forward to with sanguine expectation as the source of a great export trade. This is so more especially in Feejee, where there are at present 20,000 coffee trees in a most flourishing condition, two-thirds of which will bear fruit next year."

Colonies.

THE MURRAY RIVER DUTIES.—It appears that the New South Wales and Victorian Governments have failed to agree respecting the collection of these duties, and the former Government applied to that of North Australia again to undertake their collection, and which they have consented to do.

LAND IN SOUTH AUSTRALIA.—The area of country and suburban land sold during the year 1864 amounted to 225,171 acres, or 65,379 acres more than in 1863, bringing up the total area of purchased land to 2,893,814 acres, or 19·54 acres per head of the estimated population. At the commencement of 1864 the average for each individual was 19 acres. Two-thirds of the sold land is returned as being in the hands of freeholders maintaining the same proportion as last year. Twenty per cent. of the purchased land is under cultivation. Notwithstanding the large purchases of land for grazing purposes, it is important to note that the ratio of cultivated to untilled land is maintained as 1 to 4, the same rate as at the last twelve months. In comparison with the respective populations there is five times more land under tillage in South Australia than in the adjoining provinces, there being 4 acres to every man, woman, and child in the province, or 12 acres for every male of 14 and upwards. Seeing that of this division of the population only one-sixth are engaged in agricultural pursuits, it follows that an 80-acre section can receive but little more than the continuous labour of one statute male throughout the year. A considerable increase appears in the extent of enclosed land, which now amounts to 3,499,098 acres, compared with 2,900,291 acres, an addition of 598,807 acres, chiefly attributable to the further enclosure of land for pastoral purposes, the fenced pastorage amounting to 2,911,323 acres, against 2,344,324 acres in 1864, an increase of one-fourth. Very large areas in the south-eastern district are enclosed with sheep-proof fences of a substantial kind, the aggregate enclosure in that district alone amounting to 1,730,614 acres. Three-fourths of this fencing encloses runs held under lease from the Crown; the whole extent of sold land in the district being 366,403 acres, only 16,593 acres of which are at present under cultivation. One-fourth of the sheep in the colony are depastured within the limits of this portion of the province. The total area of land under cultivation amounts to 587,775 acres, against 555,968 acres in the previous season.

Publications Issued.

ANNUAIRE ENCYCLOPEDIQUE. (*Paris.*) 4to. 1865.—A few years since, the directors of the "Encyclopedia of the Nineteenth Century" commenced the publication of an annual supplementary volume under the title above given, and it has grown to be a work of considerable importance. It includes almost all subjects, political, scientific, literary, artistic, and industrial, official returns and other information being worked in with opinions and arguments by eminent writers. Amongst the most prominent in the new volume are articles on wages, and their relation to the price of food in the present and past times; on octroi duties, and the arguments in favour of their suppression; on the acclimatisation of Europeans in different latitudes; on asserted degeneracy of races; on the effect of consanguineous marriages; on industrial communities; on temperance societies; on religious dissent in Russia; and on the Rhenish provinces, the author of which advocates the French view of the question with daring energy. As a collection of general facts and a record of opinions in France, the annuaire in question is highly important.

Notes.

ORGANIC CHEMISTRY.—A chair of organic chemistry has just been established by Imperial decree in the College of France, and M. Marcellin Berthelot is appointed its first occupant. This is the first time that this important practical branch of scientific education has been introduced in the college course. M. Berthelot has recently made himself popularly known by a volume of synthetical lessons on the same subject, and his appointment is regarded as an advantage gained by the friends of positive as opposed to speculative science.

COPPER A CURE FOR CHOLERA.—Doctor V. Burg, of Paris, has given much attention to the preservative and curative action of copper in the case of cholera. He says that in the years 1832, 1849, and 1854, when the cholera committed sad ravages in France, the workmen who were in continual contact with copper always escaped the malady, that not one was known to be attacked even where neighbours and members of their own family were falling around. In support of this assertion Dr. Burg cites the evidence of Messieurs Calla, Chevalier, Sax, and thirty other manufacturers of articles of which copper forms a part. Dr. de Pietra Santa observed the same effect in the case of the boys in the reformatory prison of the Madelonnettes who were employed in making copper locks; and M. Péchalier and M. Saint Pierre, professors in the College of Montpellier, remarked the same fact in the case of workmen employed in the manufacture of verditer. Dr. Clever de Moldini is said to have saved the lives of many of the soldiers in garrison in Paris, by causing them to wear plates of copper next the skin, and administering a few drops of solution of salts of copper every morning and evening. In 1855 Dr. Raymond, who was with the artillery at Gallipoli and Varna, adopted the same practice with complete success. Dr. Burg attributes to copper a direct action, and says that rings or plates of the metal are very efficacious against cramps and other symptoms of cholera. He also gives those attacked, or threatened with cholera, considerable doses of salts of copper. In 1854 he carried invariably about him a diluted solution of sulphate of copper and administer it to his patients in doses of from two to ten drops in a little sugar and water, with one or two drops of laudanum, to prevent the stomach rejecting the copper. He believes copper to be with respect to cholera what quinine is with respect to fever, a sovereign remedy.

CHEMICAL EDUCATION IN FRANCE.—Chemistry is one of the sciences to which France has always paid great attention, and in none has she achieved higher renown or produced more brilliant illustrations. The names of Lavoisier, Gay-Lussac, Thénard, and others, have a world-wide reputation. At the present moment much is being done for the general extension of chemical knowledge as a portion of special education. The establishment of a chair of organic chemistry at the College of France has been lately recorded, whose doors are open to the public without any form whatever. So long as a seat remains unoccupied all the world is free to enter the lecture rooms of the establishment. Recently also a gratuitous school of practical chemistry has been created, by the joint endeavours of the famous chemist, M.

Chevreul, and his colleague, M. Frémy, at the Jardin des Plantes. This is the first instance in which a laboratory has been opened for gratuitous instruction in the practical part of the science. The Government has subscribed 10,000 francs towards the expenses of the school, which was at first supported entirely by voluntary efforts, and M. Ménier, a manufacturing chemist, has presented a like sum, the interest of which is to be applied exclusively to the current expenses of the laboratory. The new school numbers fifty or more regular pupils, and the professor, M. Frémy, now proposes to establish another laboratory to that now in existence, in order that the higher phases of the science may be pursued side by side with the educational branch; or, in other words, that young chemists may have the means of using the knowledge which they have gained in pursuing analysis and discovery. It is to this department that the donation of M. Ménier will be applied, in order that a certain number of young men, who exhibit special aptitude, may be relieved from the necessity of seeking employment yielding direct pecuniary benefit, and be able to give their undivided attention to purely scientific matters. There is little doubt but the liberality of M. Ménier will induce imitators, and if the means thus supplied should produce, or rather encourage, one or two eminent chemists only per annum, the object in view will be attained. Such scholarships will be sufficient to sustain young men of talent in their early researches, while they will in no way tend to undermine individual activity. They will supply stepping-stones, but not resting-places.

CONCRETE ARCHING.—The use of artificial stone and concretes in construction has been attempted in several forms, but generally in that of blocks previously shaped and afterwards applied like stones. In the extensive underground floors of a new barrack now erecting in Paris, the vaultings are being formed with what is called *Betons agglomérés*, the exact composition of which is kept secret by the inventor, M. Coignet. The walls are full thirteen feet apart, and the concrete is laid on timber centreings, and trodden and beaten down with great care. The vault and flooring thus formed is about two feet thick at the spring of the vaulting, but only about ten inches on the crown, and it is found sufficiently strong for all practical purposes. It has also this great advantage that the ceiling can at once be whitened and the floor laid with tiles or cement without further preparation. The process is said to be successful and economical.

Patents.

From Commissioners of Patents Journal, September 15th.

GRANTS OF PROVISIONAL PROTECTION.

Bank cheques, &c., prevention of forgery of—2101—J. G. & R. S. Dale.
Bearings, metal suitable for—2175—W. C. Cambridge.
Bed-quilts, &c., ornamenting the edges of—2253—R. Knowles and J. Lindley.
Boilers and furnaces—2291—E. and E. Green.
Bottles, securing corks in the necks of—2233—W. H. P. Gore.
Brushes—2236—G. Smith and C. Ritchie.
Carpets, &c., making and ornamenting of—2181—L. Clayton.
Carriages, &c., disconnecting horses from—2271—P. Marvaud.
Casks, &c., supplying carbonic acid gas to—2187—C. A. Watkins.
Caustic liquor or caustic lees, making of—2289—T. Nicholson.
Combination drill brace—2212—E. Davies and R. H. Taunton.
Cotton, spinning—2285—J. Pilkington.
Curved designs, sawing—2263—J. Elverson.
Electric Telegraph cables—2213—W. P. Piggott.
Engines, rotatory—2202—W. Graham, J. Broughton, and T. Corkhill.
Fabrics, dyeing and fixing colours in—2206—H. A. Bonneville.
Fustians, &c., cutting the terry or loops of—2251—J. Leslie.
Gas burners—2179—G. Bagnagatti.
Gold and silver, extracting and separating—2229—W. Crookes.
Hair, irons for curling—2283—L. Gachin.
Horse shoes—2197—J. Symmons.
Ladies' dresses, raising the skirts of—2207—H. A. Bonneville.
Land, implement for tilling—2235—S. and S. Gilbert.
Leggings, &c., fastening for—2124—F. J. Jones.
Life rafts and surf boats—2273—A. V. Newton.
Lights, &c., floating—2173—J. Moody.
Locks—2198—E. D. Hodgson.
Metallic pipes, &c., moulds for casting—2215—G. Robinson.
Ovens, &c., heating—2176—F. Thomas.
Paper, vegetable fibre for—1634—W. Deltour.
Petroleum and other oils, treatment of products obtained in refining—2195—J. Fordred.
Petroleum, &c., receptacles for—2185—G. W. Howard.
Pockets, apparatus for ensuring safety of contents of—2230—C. F. Anderson and D. Durant.
Railway carriages, safety couplings for—2159—F. C. B. Robinson.
Railway chairs, fastenings, and sleepers—2182—H. H. Henson.
Railway ticket case—2239—M. Woodifield.
Railways, permanent way of—2183—W. Rogers.
Rope, &c., manufacture of—2225—T. Cope and W. Guest.
Saucepans, &c., lids or covers for—2249—J. Ward.
Sealing-wax, &c., vessels for melting—2281—W. Bunger.
Sewing machines—2287—R. A. Purkis and G. Callaway.
Silicated alkaline inks, &c., production of—2267—H. Ellis.
Skates—2190—A. V. Newton.
Spirit meter—2193—J. F. Hearsey.
Spirits of turpentine, &c., obtaining—2247—W. E. Newton.
Steam boilers or generators—2189—W. E. Newton.
Steam hammers—2174—D. Davies.
Steam-heating apparatus—2255—A. V. Newton.
Stench trap and sink pipe protector—2220—W. H. Gummer.
Stockings—2177—F. Ayckbourn.
Submarine electric telegraph cables—2209—S. T. Jones.
Submarine telegraph cables—2257—W. Clark.
Sulphurous smokes and vapours, condensing and utilizing—2216—A. Gurilt.
Tanning—2231—J. H. Johnson.
Tar, &c., for paint—2191—J. Moule.
Tubes, cast steel or other metallic—2241—W. H. Brown.
Tubes, well-sinking—2178—W. E. Newton.
Vans, &c., for transporting furniture—2192—F. Hazeldine.
Veneers, &c., ornamenting—2279—T. T. Ponsonby.
Vessels, propelling—2223—W. Clark.
Vibration of sliding windows, retaining and preventing—2232—T. Wrigley and M. B. Westhead.
Violet dye-stuffs—2194—J. A. Wanklyn.
Waist and other belts, elongating and contracting—2224—G. F. White and H. Chamberlain.
Water, supplying boilers with—2211—A. V. Newton.
Water, supplying measured quantities of—2199—R. G. Rattray.
Water, &c., meters for measuring—2259—C. Horsley.
Wheels, removing axle-boxes from—2269—J. Drabble.
Wool, &c., combing—2222—I. and W. H. Bailey.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Oxalic acid—3124—J. Cathélaz.
Tubing or hose, flexible—2315—G. T. Bousfield.

PATENTS SEALED.

761. J. Walls.
764. J. Vero.
765. J. C. Stevenson.
774. I. Philippsthal.
777. R.T.Crawshay&I.A.Lewis.
778. S. Chatwood.
779. W. Menelaus.
780. A. R. Mackenzie.
792. W. Berry.
801. W. Clarke.
824. G. H. and J. A. Castree.
868. J. Williams.
932. J. von der Poppenburg.
1646. G. Smith.
1672. S. Godfrey.
1837. T. C. McKeen.
1844. G.C.Collyer&C.L.Roberts.

From Commissioners of Patents Journal, September 19th.

PATENTS SEALED.

785. C. Farmer and T. Turner.
787. W. Arthur.
788. R. A. Brooman.
789. W. Clark.
791. J. Smith and S. A. Chease.
793. B. J. Webber.
799. W. J. Coleman.
800. A. P. Tronchon.
804. A. Paraf.
805. J. Wright.
808. G. E. Donisthorpe.
809. W. M. Baker.
815. D. Mackenzie.
816. L. A. Leins.
818. A. B. Baron von Rathen.
821. J. Lees and M. Mellor.
823. T. Roberts and L. Luc.
826. J. C. Morgan.
827. M. P. W. Boulton.
828. W. Simons and A. Brown.
838. D. Arnold.
841. G. F. Marchisio.
843. E. Wolverson.
844. H. C. Hurry.
850. J. Dodd.
851. W. Richardson.
853. W. Betts.
866. J. C. Thompson and J. J. M. Green.
869. J. Norris.
882. J. Wright.
889. R. Holroyd and J.H.Bolton.
891. J. Player.
894. T. W. Nordenfelt.
956. W. Bulstrode.
985. R. Garrett.
990. J. Thompson.
1000. T. Skidmore.
1023. C. Vaughan.
1032. A. Turner.
1043. J. Walker.
1147. W. E. Newton.
1228. W. E. Newton.
1387. A. V. Newton.
1897. M. L. Parry.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2491. G. Ritchie.
2514. J. R. Johnson and J. S. Atkinson.
2510. A. Whytock.
2516. J. Rowell.
2526. A. V. Newton.
2531. J. Pender.
2541. S. Flexen.
2549. R. Cranston.
2562. J. W. Woodford.
2575. R. R. Jackson and J. Coupe.

THE

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THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, SEPTEMBER 29, 1865. [No. 671. Vol. XIII.

TABLE OF CONTENTS.

Proceedings of the Society.

CANTOR LECTURES.

"On some of the most important Chemical Discoveries made within the last Two Years." By Dr. F. Crace Calvert, F.R.S., F.C.S.

Lecture I.

Delivered on Tuesday, the 4th of April, 1865.

On the Discoveries in Chemistry applied to Arts and Manufactures.

In this lecture I intend to treat of chemistry applied to the arts, and more especially to some of the discoveries which have been made within the last two years. Many of these will appear to you to be incomplete, but if complete they would not be new, for seldom are discoveries perfected at once. They are generally the result of many years' study, and of the thoughtful consideration of several men.

The first part of this lecture will have reference to some of the applications which the laws of light have received during the last few years; and it will, I hope, convince you of the necessity of every one engaged in the arts making himself acquainted with all the laws connected with the phenomena of light, to enable him to appreciate the discoveries which have been made, or to assist him in improving upon those which are already known, as they are constantly receiving the most valuable applications in the arts and manufactures. Thus, for example, M. Donné has applied the properties of light to ascertain the relative values of milks by the amount of cream they contain, and this he effects by an instrument which he calls the lactoscope. Dubosch Soleil has applied with great success one of the most complicated laws of light—viz., polarised light—to the commercial estimation of the various qualities of sugars. By this process the sugar refiner, or any other person interested in that product, is enabled to ascertain in half-an-hour exactly the amount of crystallised sugar there is in a given sample, as compared with the quantity of non-crystallizable, or what is commonly called treacle. M. Dubosch Soleil's apparatus is considered so accurate that the French Government has adopted it to determine the value of raw sugars imported into the country, and the customs duties are levied upon the results given by this instrument. I may further add that this apparatus, called "Polarising Saccharometer," is based on the peculiar property which light has when polarised, or when its rays are received at an angle of 35°25′ degrees on a plate of tourmaline or a mirror. M. Dubosch Soleil's apparatus enables him to work with polarised light, which presents the various colours of the spectrum, in such a way as to enable him thereby to determine, as I have already stated, the amount of crystallizable sugar in any given quantity of the article, sufficiently accurately for all commercial purposes.

It is impossible for me, in a single lecture, to attempt to give you an idea of the various improvements which have been effected, even within the last two years, in the arts of photography, Talbotype, photozincography, glyphography, or other processes which are due to the action of light on sensitive surfaces; but you will find an excellent paper on the application of photography, and also of light to sensitive surfaces as applied to the art of engraving, in vol. xiii., page 131, of this *Journal*, by Mr. S. T. Davenport, under the heading of "Engraving and other Reproductive Art Processes." Still there are two discoveries which appear to me to deserve passing notice, viz., the carbon process of Mr. Swan, and also the process discovered by M. Villème, and now carried on in London by a company, by which the operator is enabled not only to take the photograph of a person, but to produce a statuette giving a full representation of the figure itself, and a far more accurate personification than could be produced by any sculptor, and that at a cost of as many shillings as the sculptor would expect pounds. But the most important series of researches which have been made of late years in connection with photography, and to which I deem it my duty to call especial attention, are such as to acquire more and more importance as they are more developed; I therefore feel convinced that any one who will devote his talents to the study of this particular branch of photography, will in time be amply rewarded, and of this there can be no doubt, when we consider the results already obtained by the labours of only two or three gentlemen. I refer to the reproduction of the various colours of the spectrum upon sensitive surfaces. In 1838, Herschel was the first to publish a paper on the various colours which chloride of silver is susceptible of taking under the influence of certain coloured rays of light. Mr. Robert Hunt also published, in 1840, a paper referring to the subject; but the most complete series of researches on the subject of the reproduction of the colours of the spectrum, and which led to a process by which several of the colours of the spectrum could be reproduced on a sensitive surface, is due to Edmund Becquerel. The results arrived at by this gentleman were so remarkable that they drew the attention of the whole scientific world; and the following is an outline of the processes which were applied by him to obtain this interesting result. He took a daguerreo-

type plate or a silver plated one, and having dipped it in a weak solution of chlorine, or, what was still better, a weak solution of hydrochloric acid, by connecting it with the poles of a battery, the brilliant silver surface acquired different tints, passing gradually from an opaque white to a black tint. He also observed that the tint best suited to obtain favourable results was when the plate had acquired a pearlish pink; and although he found that the plate so prepared, when placed in the camera obscura, assumed the colours composing the spectrum, still they were faint, but he remedied this defect of intensity of tints by heating for several hours to a temperature of 95° to 100° the chlorinated plate, and then submitting it to the influence of the various colours composing the spectrum. Further, in the course of his studies he made the important observation that he could replace the peculiar action of heat on his prepared daguerreotype plate by exposing it to the rays of the sun under a sheet of paper which had been steeped in an acid solution of sulphate of quinine. The effect of this was that the plate of silver assumed an intense white colour, nearly resembling that of paper; whilst, if the protective paper had not been used, the silver plate would have gradually acquired a dark tint, and would have lost the whole of its sensitive properties, the protective paper having the power of arresting completely the most refrangible rays of light, especially those which are beyond the line H of the spectrum. Notwithstanding M. Edmond Becquerel's ardent hopes to find a method which would enable him to fix on a sensitive surface the various colours of the spectrum, still he failed, for they faded immediately they were exposed to the direct rays of light, and could only be preserved in obscurity. But there is one gentleman who deserves great praise for the extraordinary perseverance which he has shown in this class of investigation. I mean the nephew of the discoverer of photography, M. Niépce de Saint Victor. Although I will not enter here into the details of these valuable researches, as they can be found in the *Comptes Rendus de l'Académie des Sciences*, still I may just be allowed to state that he has not only by the following process obtained far more brilliant colours than those first produced by M. Becquerel, but has succeeded in reproducing on sensitive plates the various colours of coloured surfaces, such as are presented by fabrics, flowers, &c., and further, he has lately been so fortunate as to reproduce on his plates yellow and black tints, which had resisted all previous attempts. To give you an idea of the facts arrived at by this gentleman, I may state that he has succeeded in so fixing upon sensitive surfaces, the various colours of the spectrum, or of coloured surfaces, that they will bear the action of diffused light for several days. In fact, I have seen photographs which reproduce faithfully a small doll dressed up in various colours, and in which even the most minute ornament could be traced, and what is certainly not less interesting was the reproduction of the irridescent colours of the peacock's feather. To obtain these marvellous results, M. Niépce de Saint Victor takes a daguerreotype, or silver-coated plate, and dips it into a weak solution of hypochlorite of sodium, having a specific gravity of 1.35, until it has assumed a bright pinkish hue. The plate is then covered with a solution of dextrine, saturated with chloride of lead; it is then dried, and subsequently submitted to the action of heat, as in M. Becquerel's experiment, or under the screen of sulphate of quinine, also referred to above. The plate is then ready to be placed in the camera obscura, and to receive the colours of the spectrum, or representations of nature, such as flowers, as well as certain colours produced by man. Lastly, he succeeds in increasing the stability of the colours developed on the sensitive surface, by covering the plate with an alcoholic solution of gum benzoin, and M. Niépce gives the name of Helio-chromie to this branch of photography.

During his lengthened reseaiches, M. Niépce de St. Victor has made two series of observations which I deem it my duty to lay before you, viz., that he can produce with facility, on prepared plates, the binary colours of the spectrum, viz., orange, violet, indigo, and green, if those colours are natural; but if they are artificially produced by the mixing of two of the primary colours, as red and yellow, or orange and blue, and yellow or blue, he cannot reproduce the binary colour, but only one of the two colours employed by the artisan to prepare them. Thus, for example, he can reproduce the natural green of malachite, and the beautiful colour known as Scheele's green, but he cannot do so with a mixture of Prussian-blue and yellow chromate of lead, the blue only reappearing. These facts enable him to explain why, in ordinary photography, the leaves of plants always appear black, and why, when he attempts to fix on his plates the colours of leaves, they have a bluish hue, the yellow portion of the colour not being reproducible.

M. Niépce has made another series of observations which deserve notice, viz., that when a plate, as prepared by his process, is dipped in an alcholic solution of substances susceptible of imparting a colour to flame, such, for example, as strontia, which communicates a red hue to it, or baryta, which gives a yellowish-green colour, the prepared plates when exposed in the camera will assume the same colour as the salt which they have on their surface would impart to the flame of alcohol; and if a salt of copper be used, which has the property of communicating a variety of tints to the flame of alcohol, the plate also will assume a variety of tints when exposed to the action of light; and during a certain period of his lengthy researches M. Niépce availed himself of this curious phenomenon to obtain coloured plates in the camera. They are not only interesting as reproductions of art, and as a feat of extraordinary skill in the progress of photography, but they are especially so because in time they will lead to methods which will enable us to communicate to our little children perfect and correct views of our time, and other interesting facts connected with the period in which we live.

All persons interested in the progress of photography will find full details of the new processes for reproducing vitrified photographic plates in vol. 60, page 1239, of the *Comptes Rendus de l'Académie des Sciences*, 1865; these I omit, as they are purely technical, and have only an interest for those immediately engaged in that branch of the photographic art.

I shall now have the pleasure of calling your attention to a most important series of researches published by Professors Bunsen and Roscoe; but, to enable you to appreciate their value, it is necessary that I should make the following remarks:—It is now well known that the solar spectrum is composed of three primary colours—blue, yellow, and red; and, also, of four complementary or binary colours, viz.—orange, green, indigo, and violet. It is also known that those colours represent different properties or qualities of that universal fluid called ether, which, I may say was generalised by Sir Isaac Newton under the name of gravitation, on which the whole of the planetary system is based, and which gives to the universe its harmony and stability. This fluid is susceptible, under certain influences, as those generated by the sun, of being set in vibration, and thus are generated heat, light, and chemical rays; and further, as there is no chemical action without a corresponding production of electricity, it follows that electricity, as well as magnetism, may be considered as a mere modification in the vibrations of the same fluid. Therefore we may truly say that all the imponderable fluids called Light, Electricity, Heat, Magnetism, and Force, have all the same origin, namely, the fluid called ether, and which, according to the nature of the vibrations, developes or renders palpable to our senses one of those fluids. In fact, I feel convinced that this unique fluid is not converted into those divers fluids by special modifications of its own vibrations, but that they only become manifest to our senses when it has imparted its own or special vibration to the particles of matter, and that it is

the peculiar vibration which it imparts to the molecules of matter that developes in the molecules themselves such a mode of vibration as gives birth to what we call light, electricity, magnetism, heat, and force. In fact, there is no doubt, from the researches of Dr. J. P. Joule, Professors William Thomson, Mayers, and others, that heat and force are the same fluid, for Dr. Joule has given us the exact measurement of that force. He has demonstrated that the amount of heat necessary to raise one pound of water one degree in temperature, would, if applied mechanically be competent to raise one pound weight 772 feet high, or it would raise 772 pounds one foot high. The term "foot pound" has been introduced to express in a convenient or systematic way the lifting of 772lbs. to the height of one foot. Thus the quantity of heat necessary to raise the temperature of a pound of water one degree being taken as a standard, 772 foot pounds statute, is what is called the mechanical equivalent of heat. Dr. Tyndall, in his valuable work on "Heat considered as a Mode of Motion," gives many interesting examples of the conversion of heat into force, and *vice-versa.* For example, he cites the following theory of Professor Thomson, who assumes that an immense amount of force is converted into heat when meteoric matter is attracted to the surface of the sun by the molecular attraction called gravitation; that the force generated by the immense velocity with which meteoric matters travel towards the sun, becomes converted instantly by its contact with the sun into heat; and further, he considers, that the showering of meteoric matter, as well as that of the zodiacal lights on the sun's surface, are sufficient to acount for the immense heat which he supposes the sun's surface to possess. I must say that I do not believe that the sun possesses much heat or light; I believe that it is only an immense mass which, by its size as compared with the rest of the planetary system becomes the centre of gravitation; and that there exists between it and the planetary bodies a constant state of attraction; that the fluid called ether, which represents the force called gravitation, is in a constant state of activity throughout the universe, and brings about that Godly and admirable harmony which pervades it; and although the ether filling space can be considered in a constant state of action or vibration, and convertible into the fluids which we call heat, light, electricity, and magnetism, still these fluids only become manifest to our senses when they put into vibration the particles of matter, or produce, according to their peculiar vibration, the phenomena of light, electricity, magnetism, heat, and force; for if heat is convertible into force, as asserted by the researches of the eminent *savants* above stated, why should not the production of other fluids be due also to similar phenomena? If it be true, as Joule, Thomson, and others contend, that force and heat are due to the vibration of the molecules of matter, and that according to the rapidity of the vibrations of such atoms (imparted to them by the vibrations of ether) one or other of these forces is engendered, why should not the manifestations of other fluids be traced to similar causes? In fact, no doubt can exist in my opinion with respect to electricity and magnetism, for if their manifestations to our senses were owing to the vibration of a universal force it would affect all bodies in the same way and in the same degree. Now this is not the case; for there are good and bad conductors. Therefore it follows that the atoms composing matter, or more so, their nature, have an influence on its degree of manifestation. The same with magnetism; for we find oxygen to be magnetic, and nitrogen non-magnetic or diamagnetic. Thus it appears to me from these facts, which might be multiplied if time permitted, that the manifestations of heat, force, electricity, and magnetism are not peculiar and distinctive fluids, but are due to the modification in the mode of vibration of the universal fluid called ether, which imparts to matter its peculiar undulations, and that these forces are only made manifest to us when the vibrations come into contact with solid matters such as compose the atmosphere or the earth. Therefore, I am of opinion that there is no light, heat, electricity, or magnetism beyond the limits of the atmosphere which surround the earth; but that when the ether, which is in a state of vibration, comes in contact with the particles of matter composing our atmosphere it then communicates one of its own peculiar vibrations to these particles; then they, by their vibrations, become luminous. If this theory is correct, it follows that the production of the phenomena of light is due to the vibrations of solid matter, and not to the vibrations of the ether, as is assumed by the philosophers of the day.

I very well know that these views of mine are completely in contradiction with those entertained by most of the philosophers of the day; but still I hope to be able to publish a sufficient number of scientific researches, as well as to draw attention to such a number of physical, chemical, and astronomical facts as may, even if not proving the truth of my views, at all events, I hope, deserve some attention.

Now, let us return to the subject under consideration, viz., that a spectrum is produced by the decomposition of light when it is refracted at an angle of 60°; and that the result of that decomposition is the production of three primary and four binary or complementary colours. Further, that the red portion of the spectrum represents calorific rays of light; that the green and yellow represent light-giving rays, and violet and the rays beyond it the chemical or actinic rays of the same. Philosophers have for a long period been able to measure accurately the intensity of the heat-giving rays, by means of a thermometer or the thermo-electric pile; and though we had a general knowledge of the intensity of the chemical rays of light, still we had no method of accurately measuring its real intensity, and conveying our results and observations to others, till Professors Bunsen and Roscoe filled up this important gap. These gentlemen's researches will be of great service to science and to society, as they will throw much light on many meteorological data, and enable a chemist to study with more precision than has been previously done the chemical phenomena of vegetation and other phenomena connected with the chemistry of agriculture. For example, the thermometric observations giving the mean monthly or yearly temperature of a country, by no means yield all the data required for the estimation of the true climatology of the place, or of its plant or animal producing capabilities. For these purposes we require to have not only the amount of solar heat directly or indirectly reaching the spot, but likewise the amount of chemical active solar light which may be present there. This is strikingly exemplified by the following example given by Dr. Roscoe on a comparison of the mean annual temperature between Thorshawn, north latitude, 62° 2′; west longitude, 6° 46″; temperature, 45° 6′; and Carlisle, north latitude, 54° 55′; west longitude, 2° 58″; temperature, 46·9°; difference, 1·3. From these figures it will be seen that the mean annual temperature is nearly equal, but the quantity of sunlight falling upon those two places differs most widely, and we have a corresponding difference in true climatological results. Thus the flora of the Faroe Islands and the Shetland Islands is of a most limited description. Only hardy varieties of shrubs, and no trees or flowers exist there, while at Carlisle we have a luxuriant vegetation accompanying a most sunny sky. How essential, then, are the rays of light to vegetation. These gentlemen have also ascertained that those rays are in ratio with the intensity of that light; and still further they are also in ratio with the chemical or actinic rays of the sun; and thus the researches of these savants will enable them to measure with accuracy those chemical actions. It is impossible, in a lecture like this, to render justice to their researches, therefore I must refer those who wish to consult them to the Philosophical Transactions of the Royal Society. Still I may state that

these gentlemen's photochemical instruments are based on the following data, namely, that equal intensity of light produces in the same given space of time equal shades of tint on surfaces prepared with chloride of silver of uniform sensitiveness. Thus it is shown by experiments that a tint attained by paper so prepared is constant when the quantity of light falling upon it also remains constant. Light of an intensity of 50° falling upon a paper for the time of one minute produces the same blackening effect as light of the intensity of one falling upon it for the time of 50 minutes. Knowing these laws which regulate the degree of shade of the paper, and having a surface of a perfectly constant degree of sensitiveness, it is easy to obtain the absolute measurement of the chemical action of light.

The next discovery to which I desire to draw your attention is still in its infancy; but I am induced to refer to it from two considerations. The first, that it may render great service to society by enabling us to preserve the lives of many thousands of our fellow-creatures in our coal-mines and other underground works, and also because it is a beautiful illustration of the amount of knowledge that a man requires at the present day either to understand or appreciate fully the discoveries of others, or to enable him to attempt any original invention of his own. Unless a person possesses the rudiments of the leading sciences of the day he will never be anything but an imitator, and will never succeed in improving the inventions already made. It is certainly most interesting to witness how the most abstruse branches of science are brought to bear on arts and manufactures, and no better example can be given than the application of electricity under various forms to what is commonly called the telegraph. The invention which I am now about to bring to your notice is due to M. Dumas, a young French engineer, and to M. Brequet, of Paris, who is also practically connected with telegraphy. To enable these gentlemen to carry out their discovery they have had to study, and be perfectly acquainted with, the researches of many of the most eminent men that science has produced during the last half century. Thus they employ the galvanic battery which was discovered by Galvani, and perfected by many philosophers, until brought at last to its present perfection. They use a mixture of bichromate of potash and sulphuric acid in a Bunsen battery. They have also had recourse to magneto-electricity, first discovered by Faraday, and brought to its present perfection by the researches of MM. Nobili, Mason, Becquerel, Joule, and others; and to enable them to construct their apparatus they have applied, with great ingenuity, the inductive coil, the result of many successive discoveries, and brought to great perfection by Ruhmkorff, the vibrating interrupter of Dancer, and also the condenser of Fiquier. Further, they must have had the knowledge of the stratified light and the application of it by Gassiot; the fluorescence of light by Stokes and Becquerel, and their applications to glass by Geissler. All these facts prove the correctness of my statement, how vast is the amount of knowledge required to make a little discovery. The apparatus invented by these gentlemen is portable, for a miner carries on his back the above-mentioned galvanic battery, and this generates the force required, which is multiplied, increased, and brought to light by the Ruhmkorff coil, which is also confined in the same leather case, occupying only six inches; the magneto-electricity passes through wires covered by vulcanised india-rubber, and these are in connection with a thick glass tube, in which a vacuum has been made, and this contains a fluorescent tube of Geissler, which becomes luminous or fluorescent by the passage of the electricity through it, generated by the coil and the battery.

Although both light and electricity are most interesting subjects, and could well be made the subject of many lectures, still I am bound to leave them on one side, and draw your attention to other facts deserving of notice. It is well known to all chemists and philosophers that matter has a great tendency to assume a geometrical or crystalline form, and that whenever the atoms of matter are sufficiently free for molecular attraction to have its full influences attraction between the atoms takes place, and gives birth to well-defined crystals. The following examples can be cited:—The slow condensation of the vapour of iodine, which gives rise to well-defined crystals, as well as those of camphor and other volatile bodies. When sulphur, bismuth, and other substances are melted, and allowed to cool slowly, and the excess of the fluid remaining among the crystals is poured off, well-defined crystals are found to exist in the mass, which apparently would have disappeared had not the excess of fluids been poured off, for in this case the molecules of the remaining fluid mass would have solidified among the crystals, and would have prevented the observer from seeing that the molecules when freed in the fused mass had assumed a crystalline form. The tendency of molecules to assume a geometrical form presents in many instances curious phenomena. Thus, for example, a vessel may contain acetic and carbolic acids—and if, say at a temperature of 40° or 50°, a crystal of either of those substances is placed in contact with its own fluid, the entire bulk of fluid passes in a few seconds into a solid crystalline mass. The manifestation of that force is also beautifully illustrated in the following instance:—If a tin plate be heated to a moderate temperature, and a drop of water be allowed to fall on its surface, and the plate be dipped for a few minutes into weak muriatic acid, it will be observed that the whole surface of the plate is affected, and that where the water fell it has assumed a most beautifully waved and irridescent surface. If this surface be examined under the microscope it will be found that under the influence of the vibrations generated by the cold fluid falling upon the heated plate, the mass of molecules have passed from their amorphous condition to that of a crystallised one. We all know this alteration in the tin-plate surface was particularly applied many years ago to produce variegated surfaces on our tea-trays and other similar domestic vessels. It should also be stated that this effect was greatly enhanced by the skilful application of coloured varnishes, which increased the value of the mercantile article. This discovery, which is due to an eminent chemist of the name of Prout, clearly proves, as those before cited, the power which matter has to assume a crystalline form. I cannot, however, refrain from adding the following instances, in which the mere vibration of particles of matter is sufficient to change amorphous bodies into crystalline ones. The first is that which often takes place in the iron used on railways. The most striking example is that of the iron links used to unite waggons where it is found that the fibrous, tenacious link made of malleable iron is transformed into a crystallised, brittle link by the constant vibration it is subjected to by railway traffic. Another example is that shown by the peculiar action exercised by intense cold on the molecular state of iron, as shown by the brittleness of the metal in Russia and other cold climates; this was the case in December, 1859, in England, when, as will be remembered with regret, many railway accidents occurred, owing to the rails becoming crystallised and brittle.

The power which molecules have to assume a crystalline form has recently been the study of Mr. F. Kulhmann, an eminent chemist of Lisle, and he has given to that force the name "crystallogenic." I shall endeavour to lay before you a short epitome of his researches, which are not only interesting in a scientific point of view, but also in consequence of the mode in which he has applied it in connection with arts and manufactures; and those who take an especial interest in the matter will read with pleasure his researches in the *Comptes Rendus de l'Académie des Sciences de Paris.* M. Kulhmann, having mixed a certain class of substances which crystallised with facility, such as mannite, sulphate of zinc iron, copper, with a thick solution of gum, or any other

substances interfering with the free crystallisation of these substances and having spread the mixtures on glass, he found, by exposing such prepared plates to the atmosphere, that gradually the water would evaporate, leaving a dry mass, in which could be observed most beautiful arborizations. Each of the solutions will produce a well-defined design which is not always identical although operating under the same circumstances. Still they assume very similar forms, being in some instances that of stars, and in others that of leaves and wreaths. These modifications are obtained by the strength of the solution, the nature of the salt and the mode of preparation. Kulhmann further observed, that if amorphous substances, such as magnesia and sesqui-oxide of iron, or chromium, be mixed with bodies susceptible of crystallisation, and these added to a gummy fluid, the amorphous particles are drawn into the crystallising substances and follow the outlines; and if these are produced on surfaces, such as those of glass or porcelain, and heat applied, the gummy matter will be destroyed or volatilised, and the crystalline medium and the amorphous substances become incorporated, and fixed in the porcelain, reproducing on its surface a crystallogenic design. These researches which I have the pleasure to lay before you will show you the probability of carrying out these results to a satisfactory issue. Of course, the glass or porcelain manufacturer will easily understand that he will have to use borax or phosphate of soda, or other flux, as a crystallising medium, if he wants to produce in his art the results that I have stated. M. Kulhmann has applied his crystallogenic process with great success to photography, and also to the art of engraving metals. As the latter may have some interest, I will give you an outline of his process. It consists in producing a crystalogenic design on the surface of an iron or copper plate, and then applying on the so-prepared surface—say a sheet of lead or copper—and submitting them to high pressure when the design would be impressed upon the plate. The embossed plates, by being placed in a prepared solution, and in connection with a galvanic current, will easily give birth to a *fac-simile* in relief, which can be used as a printing surface. It is with pleasure that I am able to state that though I part with these interesting researches for the present, I shall have the satisfaction of referring to them again in a subsequent part of this course of lectures, when I shall speak of some researches of this gentleman which have a more immediate bearing on the progress of science.

It has been for a long time a disputed question whether the stained windows we all admire in old cathedrals could be restored in such a way as to resume the brilliancy they had at the time they were placed there by the artists. At all events there is now no doubt that this can be effected by the process discovered by my eminent master, M. E. Chevreul, as is proved by the application of it in connection with the restoration of stained windows existing in a well-known church in Paris—that from which the tocsin of St. Bartholomew was sounded, "St. Germain des Près." The process devised by M. Chevreul is highly practical; it consists in removing the stained glass from the windows, and dipping it for several days, first, in a weak solution of carbonate of soda of a specific gravity of 1·068, then washing it, and dipping it for several hours in a solution of muriatic acid of a specific gravity of 1·080. On the glass being washed and dried, it will be found as brilliant and beautiful as when it came from the hand of the manufacturer. M. Chevreul has found that the dim and dirty appearance which stained glass assumes by time is due, especially in large towns, to the various products of smoke being first condensed on the glass by fog and rain, and then becoming oxydised they act as a cement to various mineral matters, such as chalk, gypsum, oxyde of iron, &c., which help to impoverish the transparency of the glass. The alkali acts upon the organic matter and dissolves it, while the muriatic acid removes the minerals. The durability of glass placed in our monuments is extraordinary, when we bear in mind the curious results published some years since by the eminent chemist, Pelouze, who observed that when window, bottle, and other varieties of glass were reduced to a fine powder, and mixed with water, they were soon acted on, yielding a large quantity of silicate of soda to that fluid, amounting in several cases to eight or ten per cent. in cold water, and even to thirty-six per cent. when the finely pulverised glass was boiled in water; and that, in many cases, it was a definite compound which was dissolved from the glass, namely, a silicate of soda, composed of three equivalents of silica and two equivalents of soda. M. Pelouze explains the extraordinary difference in the effect which water produces on glass when in large masses or plates, as compared with its influence on the same substance when reduced into a fine state of powder, by assuming that, in the first instance, water does not act because it seldom remains sufficiently long in contact with the glass to act upon the elements which compose it; while, in the second case, there exist numerous points of contact between the fluid and the solid body, thus facilitating the action of the fluid on the solid material. I am inclined to think that the peculiar molecular condition the surface of glass assumes, when manufactured in plates or otherwise, must exercise a great influence on the property which glass has to resist the action of water. If it were not so, how could be explained the limited action which watery fluids, such as wine, cause upon the interior surface of a bottle, though they remain in contact for many years? I can conceive glass assuming a peculiar surface by the pressure of the atmosphere, thereby producing a homogeneous one susceptible of resisting the action of water. A similar instance occurs in the case of polished steel, or of the rolled surface of wrought iron, or the skin of cast iron, which resist the chemical action of either air or acids in a far greater degree than does the interior of the substances which compose those metallic bodies.

Whilst dwelling upon old materials, you will allow me to give you an outline of a process devised by M. Stahl for the preservation of antediluvian fossils. We are aware how interesting it is to preserve relics of past ages, giving us some of the conditions of the world at various periods. Those relics are exceedingly fragile, and after many clumsy attempts M. Stahl arrived at his discovery. If the fossil is compact and comparatively firm, it is saturated by means of a brush with melted spermaceti, but if it is friable, it is necessary to employ a melted mass composed of four parts of spermaceti and one of colophany resin, which in cooling gives great solidity to the mass of the fossil.

I would, in conclusion, draw the special attention to all artists who take an interest in decorative art to the interesting papers published recently by M. Onfroy on the one hand, and M. Wiel, of Paris, on the other; the first being in the *Technologiste* of last year, the latter in the *Annales de Chimie et de Physique*, on their respective methods for covering a metal with another more valuable by its properties or precious by its qualities. These methods have a special reference to cast iron or wrought iron. In Paris these processes, which may be regarded as not only ornamental but useful, have been applied with great success. Thus, for example, instead of the dirty, pitchy black lamposts which ornament our English towns, there can be seen in Paris elegant, well-designed, bronze-like posts, which are pleasing to the eye. The same can be said of the fountains on the Boulevard Sebastopol, the Place de la Concorde, and many other public promenades in Paris, which excite the admiration of foreigners visiting that city.

PORTUGUESE INTERNATIONAL EXHIBITION.

The Portuguese International Exhibition was opened on the 18th of September, with great rejoicings. At one o'clock in the afternoon the King and Queen, Dom Fer-

dinand, and Dom Augusto, entered the Crystal Palace with a brilliant suite, and were conducted through the central nave to the throne prepared for their Majesties; an address was then delivered by Senhor Antonio Braga, President of the Central Committee of the undertaking, to which the King replied in the following terms:—

"Among you, illustrious Portuguese, none may doubt of our progress, none may fear that it is slow and indefinite.

"Nations fall from their splendour by the errors of men or natural calamities. But it is also certain that they rise gloriously to the resonant voice of patriotism and liberty. And with the same rapidity with which they were cast down are they impelled towards prosperity, if with good faith and firm steps they enter upon the path of reforms, the sole course by which the moral and physical regeneration of peoples can be effected.

"This movement, once commenced, becomes a necessity of such magnitude and urgency, that no benefit remains circumscribed by the area traced out by its author.

"Thus Portugal, after a long period of misfortune, which caused her to lose the *prestige* of her past greatness, has now, Providence be thanked, entered upon a new epoch of efforts and enterprises, which, encouraged and fortified by peace and liberty, will assure to her, in a brief future, the place which she once occupied among the most cultivated and fortunate nations.

"The first International Exhibition which took place in the capital of the commercial world was followed by that of Paris. And such is the power and influence of the progress of humanity, that in little more than ten years a city of the second order, in a country hitherto considered to be a century behind most nations, gathers to her bay, for your honour, the manufactures of both worlds and the wonders of art and intelligence.

"This spectacle is, then, a great glory for Portugal, and a well-founded hope for the future. Arduous was the mission of my honoured grandfather in implanting the liberal institutions we now enjoy; and arduous also the task of my august brother, evangelising and exalting among us the sublime idea of the supremacy and glorification of labour.

"Such facts cannot be forgotten, and your allusion to them at once affects and gratifies me.

"Invited by you to assume the presidency of the Crystal Palace, and later to give an impetus, as you express it, to the development of the Exhibition, I acceded with the greatest pleasure, recognising all the importance of the undertaking.

"The spirit of the age, the example of my brother, and the love I bear to my country and my subjects, will lead me to embrace and second with all my endeavours this generous and highly civilising idea, whose realisation will give to our country much higher consideration among foreign nations, and will increase our own self-respect, thus raising public spirit to the height from which naturally and spontaneously spring patriotic actions.

"This contest of labour, this truly national festival, is so striking a proof that we are advancing on the path of progress, it opens up to the national industry so many improvements, and promises such various advantages to the country, that I feel real pride that this great event should take place as a happy presage at the commencement of my reign.

"My honoured father, the enlightened president of the Exhibition, accepted and undertook in the same manner so pleasing a charge. His august name, as you well presumed, immediately secured the public sympathy for this great work. The most distinguished artists, and the most intelligent and industrious nations, hastened to respond to our invitation. No nation, however powerful and advanced, disdained to come and take their place among the laborious Portuguese. Honour to them for this, as it is to us a motive of gratitude.

"To the wishes you express for my happiness, that of my beloved consort, the Prince my august father, the Infante Dom Augusto, and the Royal Family, I respond with the most fervent wishes for the greatness and welfare of the country which has been our cradle."

His Majesty concluded by declaring the exhibition open, amidst the greatest enthusiasm from the numerous and select concourse of spectators, native and foreign. Royal salutes were fired from the forts of Serra do Pilar and Foz in honour of the event. The royal party were afterwards conducted over the various departments of the building, several pieces, specially composed for the occasion, being meanwhile performed on the great organ. The greater part of the foreign diplomatic corps, the whole of the consular body, all the ministers, the court dignitaries, and nearly all the members of parliament, were present at the ceremony, which was favoured by splendid weather. England is very well represented, the display of her manufactures being excellent.

PARIS UNIVERSAL EXHIBITION OF 1867.

The Imperial Commission has issued the following regulations specially referring to British exhibitors:

Section I.—General Arrangements and System of Classification.

Art. 1.—The Universal Exhibition to be held at Paris in 1867 will be open for the reception of works of art and of the products of agriculture and industry of all nations. It will be held in a temporary building on the Champ de Mars. Around the Exhibition building a park will be formed for the reception of cattle and other live animals, and plants, as well as for those constructions and objects which cannot be exhibited in the main buildings. The Exhibition will open on the 1st of April, 1867, and will close on the 31st of October following.

Art. 5.—The commissions appointed by the various foreign Governments to direct the part which their respective countrymen will take in the Universal Exhibition are in direct communication with the Imperial Commission relative to the exhibition of the works of art and other productions of their country. Consequently, the Imperial Commission will not correspond with foreign exhibitors. Products sent by a foreign exhibitor can only be admitted through the medium of the foreign commission which represents him. The foreign commission will also provide, as they may see fit, for the carriage, the reception, the arrangement, and the return of the productions of their countrymen. They must, however, conform to the regulations laid down by the Imperial Commission.

Art. 6.—Foreign commissioners are requested to place themselves as soon as possible in relation with the Imperial Commission, and to depute some person to represent them. The duty of this representative will be to arrange the questions which refer to foreign exhibitors, and particularly those relative to the allotment of the whole space among the various countries, and to the manner in which each foreign section shall be arranged in the Exhibition building and in the park.

Art. 7.—In order to facilitate the division of the space allotted to each country between the various classes of objects enumerated in Article 11, the Imperial Commission will place at the disposal of the representatives for their guidance the plan of the arrangement of the French section of the Exhibition building, drawn on a scale of two millimetres to a metre (1in. to 41·6ft. or 1-500th). This plan shows the arrangement of the glass cases and counters suitable for each class of objects, as well as the shape, height, and other dimensions of the courts intended for each class. An analogous plan of arrangement, showing the manner in which the portions of the Exhibition building allotted to each foreign country will be subdivided, is to be transmitted to the Imperial Commission before the 31st of October, 1865. Plans in detail, on a scale of two centimetres to the metre (1in. to 4·16ft., or 1-50th), showing the place allotted to each exhibitor and to each

separate stall, are also to be forwarded with the list of exhibitors by each foreign commissioner before the 31st of January, 1866, in order that in arranging the interior of the Exhibition building the Imperial Commission may be able to take into consideration the wants of each country.

Art. 8.—Each foreign country may claim, for the formation of a special park, the portion of the Champ de Mars adjoining the space allotted to it in the Exhibition building. The representative of each foreign commission will settle with the General Commissioner the plan of the paths for the circulation of the public, and of the earthworks, which will be executed at the cost and under the direction of the Imperial Commission. Each representative will also arrange with the General Commissioner, so as to leave at the disposal of the Imperial Commission the portions of the ground which may be in excess of the wants of his countrymen, or to obtain an additional piece of ground from the portions to which other representatives may have given up their claim. In order to facilitate as much as possible the arrangements of the foreign exhibitors in the portions of the park allotted to them, the Imperial Commission will place at the disposal of the representatives for their guidance the plans adopted by the French exhibitors for arranging the animals, plants, model cottages, &c.

Art. 9.—An official catalogue of the products of all the foreign countries will be drawn up, showing the place which they occupy either in the Exhibition building or in the park. This catalogue will contain two alphabetical lists—one of the exhibitors, the other of the products exhibited. Foreign commissioners are requested to send the information necessary for the preparation of the catalogue before the 31st of January, 1866.

Art.—10.—Those States which can only be represented in Paris in 1867 by a small number of exhibitors, and which are besides in a similar geographical position, are requested to concert together so as to insure a methodical grouping of the products of an analogous nature. The Imperial Commission will place at the disposal of the representatives of the commissions of those States the plans which have been prepared, with a view to harmonize the advantages of such a grouping with the fundamental rule of national representation. In the event of these plans being approved, the Imperial Commission requests the commissioners of these same States to appoint in Paris for each group an agent whose duty it will be to carry them out. The architects and officers of the Imperial Commission will afford assistance gratuitously to these agents.

Art. 11.—In each section assigned to the exhibitors of the same country the objects will be divided into 10 groups and 95 classes, viz.:—

1st Group.—Works of art (classes 1 to 5).

2nd Group.—Apparatus and applications of the liberal arts (classes 6 to 13).

3rd Group.—Furniture and other articles intended for dwelling houses (classes 14 to 26).

4th Group.—Clothing (including fabrics) and other articles worn on the person (classes 27 to 39).

5th Group.—Products (raw and manufactured) of mining (classes 40 to 46).

6th Group.—Instruments and processes of the common arts (classes 47 to 66).

7th Group.—Food (fresh and preserved) in various states of preparation (classes 67 to 73).

8th Group.—Live products and examples of agricultural establishments (classes 74 to 82).

9th Group.—Live products and examples of horticultural establishments (classes 84 to 88).

10th Group.—Objects exhibited with the special purpose of improving the physical and moral condition of the people (classes 89 to 95).

The objects which are included in these groups are given in detail in the System of Classification (Appendix A) annexed to these regulations. In order to avail itself of any suggestions that may be made by the French exhibitors and the Foreign commissioners, the Imperial Commission reserves to itself the right to resolve, in the successive editions of this document, all doubtful questions to which this first publication may give rise.

Art. 12.—No work of art or object exhibited in the Exhibition building or in the Park may be drawn, copied, or reproduced in any manner whatever, without the authority of the exhibitor who is the author of it. The Imperial Commission reserves to itself the right to authorize the taking of general views of the Exhibition.

Art. 13.—No work of art or object exhibited may be removed before the close of the Exhibition without the special authority of the Imperial Commission.

Art. 14.—Neither French nor foreign exhibitors will have to pay any rent for the space occupied by them in the Exhibition, but all costs incurred for fittings and decoration in the Exhibition building and in the park must be borne by them.

Art. 15.—Frenchmen and foreigners, by the act of becoming exhibitors, thereby bind themselves to adhere to these regulations.

Art. 18.—Works by French and foreign artists, executed since the 1st of January, 1855, will be received for exhibition.

Art. 19.—The following will not be received:—1. Copies, including those which reproduce a work in a manner different to that of the original. 2. Oil paintings, miniatures, water-colour paintings, pastels, designs and cartoons for stained glass and frescoes, without frames. 3. Sculpture in unbaked clay.

Art. 22.—The number and nature of the rewards that may be given in respect of works of art, as well as the constitution of the international jury who will be called upon to act as judges, will be decided hereafter.

Art. 23.—All the products of agriculture and industry will be admitted into the Exhibition with the exceptions and limitations mentioned in the following article.

Art. 24.—Detonating, explosive, and other substances of a dangerous nature will not be admitted. Spirits and alcohols, oils and essences, corrosive substances, and generally substances which may affect injuriously other products exhibited, or incommode the public, will only be received in strong vessels, specially adapted for the purpose, and of small dimensions. Percussion caps, fireworks, lucifer matches, and other similar articles can only be received when made in imitation and deprived of all inflammable ingredients.

Art. 25.—Exhibitors of products of an unwholesome and disagreeable nature will be bound to conform at all times to such measures of safety as may be prescribed to them. The Imperial Commission reserves to itself the right to cause the removal of any products, whether French or foreign, which by their nature or their bulk might appear injurious, unsuitable, or incompatible with the objects of the Exhibition.

Art. 36.—Exhibitors of apparatus requiring the use of water, gas, or steam, are to state, when sending in their application for space, what amount of water, gas, or steam, will be necessary. Those who wish to exhibit machines in motion are to state at what speed each of these machines is to be driven and the motive power which it will require.

Art. 39.—The cost of packing and carriage of the goods sent to the Exhibition, and of the goods which have been exhibited there, is to be borne by the exhibitors, both to and fro.

Art. 42.—Packages from foreign countries must be marked in such a way as to show distinctly whence they come. The Imperial Commission will make arangements with the Foreign Commissioners in order that these packages may be transmitted in accordance with the regulations specified in Article 40 for French packages; on this point, however, the Foreign Commissioners will adopt the course which they may consider most advisable.

Art. 43.—French and foreign goods will be received into the Exhibition from the 15th of January, 1867, up to the 10th of March following, inclusive.

Art. 44.—The Exhibition is constituted a bonded warehouse. Foreign goods intended for the Exhibition will be admitted into France, under bond, up to the 5th of March, 1867, by the following ports and frontier towns:—Dunkirk, Lille, Valenciennes, Feignies, Jeumont, Vireux, Givet, Longwy, Thionville, Forbach, Wissembourg, Strasbourg, St. Louis, Pontarlier, Bellegarde, St. Michel, Nice, Marseilles, Cette, Le Perthus, Hendaye, Bayonne, Bordeaux, Nantes, St. Nazaire, Granville, Havre, Dieppe, Rouen, Boulogne, Calais.

Art. 45.—The Imperial Commission will issue special instructions relative to the period when the materials for the buildings, as objects for exhibition, the separate parts of machines and apparatus, heavy and cumbersome articles, and those which require masonry or special foundations, are to be brought into the precincts of the Exhibition. Such works are to be performed by the exhibitors, and at their own cost, in accordance with the plans submitted by them for the approval of the Imperial Commission.

Art. 46.—The Imperial Commission will supply gratuitously the water, gas, steam, and motive power for the machines admitted under the regulation contained in Article 36. This motive power will, except in special cases, be transmitted by a horizontal main shaft, the diameter and the number of revolutions per minute of which will be made known by the Imperial Commission before the 31st of December, 1865. The exhibitors will have to furnish driving pulleys on the main shaft, connecting pulleys, and intermediate shafting for the purpose of regulating the proper speed of the apparatus, as well as the belts necessary for each of these motions. Steam-engines which require to be supplied with steam from their own boilers cannot be shown in the Exhibition building, and special directions will therefore be issued respecting them.

Art. 47.—All other expenses, such as the employment of workmen in the building, the reception and opening of packages, the removal and charge of packing-cases, the construction of counters, stages, glass and other cases, &c., the placing of goods in the Exhibition building and in the park, the decoration of the stalls, and the return of the goods, are to be borne by the exhibitors, French as well as foreign.

Art. 49.—The various stalls and fittings may be erected in the Exhibition as fast as the buildings are completed; they must be commenced at latest on the 1st December, 1866, and must be ready for the reception of goods before the 15th of January, 1867.

Art. 50.—The passages reserved outside the exhibiting space being strictly calculated for the purpose of circulation, packages and empty cases are not allowed to remain therein. Cases must therefore be unpacked as fast as they are received. The Imperial Commission will direct its own officers to unpack for the exhibitors, and at their risk and peril the cases left in the passages intended for circulation. From the 11th to the 28th of March, 1867, the goods already unpacked and placed in the stalls are to be arranged and displayed for exhibiton. The 29th and 30th of March are reserved for the purpose of a general cleaning. A review of the whole Exhibition will take place on the 31st of March. The Imperial Commission will take all measures necessary to have the Exhibition complete in all its parts by the 28th of March. It will, therefore dispose of all those portions of space which on the 14th of January, 1867, are not occupied by stalls ready for the reception of goods, and of all those stalls which on the 10th of March do not contain goods enough to fill them.

Art. 51.—Immediately after they have been unpacked the cases that have been used for the carriage of the goods, either in France or from abroad, are to be removed by the exhibitors or their agents. If they should fail to do this without delay, the Imperial Commission will remove the cases and packing, and will not be in any way responsible for their preservation.

Art. 52.—Special instructions will be published hereafter for the organisation and arrangement of the products and objects for exhibition which are to be placed in the park.

Art. 53.—The name of the producer will be affixed to the goods exhibited. The name of the retailer who usually acts as his agent may be added with the producer's consent. The Imperial Commission will, when required, make arrangements for the exhibition of goods under the name of the retailer when they are not sent for exhibition by the producer.

Art. 54.—Exhibitors are requested to insert after their own names, or the names of their firms, the names of those persons who have contributed in a special manner to the merit of the products exhibited, either as inventors or designers, or by some process of manufacture, or by some remarkable skill in the workmanship.

Art. 55.—The cash price of the objects exhibited and the place where they may be purchased may be stated. This information must be given upon all objects included in Class 91. In all the classes the prices, if stated, must be adhered to by the exhibitor as respects the buyer, under penalty of exclusion from competition. Objects sold may not be removed before the close of the Exhibition without the special permission of the Imperial Commission.

Art. 56.—The Imperial Commission will take every means to preserve from damage the articles exhibited, but it will not hold itself in any way responsible for any loss by fire, or for any accident, damage, or injury, great or small, which may happen to them, from whatever cause it may arise. Exhibitors must take upon themselves the expense of insurance if they should see fit to avail themselves of that precaution. The goods exhibited will be watched by the necessary staff, but the Commission will not be responsible for any thefts or embezzlements which may be committed.

Art. 57.—A special notice posted in the Exhibition building and in the park will make known the staff appointed to organise the interior of the building. It will also contain the names of the officers whose duty it will be to give assistance to the exhibitors, and to watch over the security of the Exhibition.

Art. 58.—A ticket will be delivered to each exhibitor, which will give him free admission to the Exhibition. This ticket will not be transferable. If it should be proved that the exhibitor has lent or given his ticket to some other person, it will be forfeited without prejudice to further proceedings at law. To secure the carrying out of this regulation, the ticket of admission must be signed by the holder, who will have to enter the Exhibition by certain prescribed doors only, and he may be required to establish his identity by signing his name in a book to be kept for that purpose.

Art. 59.—Exhibitors will be allowed to have their goods taken care of by the agents they may select, but they must be approved by the Imperial Commission. Personal tickets of free admission will be given to those agents under the conditions laid down in the foregoing Article. An exhibitor's agent can only receive one ticket of admission whatever number of exhibitors he may represent.

Art. 60.—Exhibitors or their agents must not solicit visitors to make purchases; they will confine themselves to answering inquiries, to handing the address cards, prospectuses, and lists of prices which they may be asked for.

Art. 61.—The Imperial Commission will fix hereafter the prices of admission to be paid by visitors in order to be admitted into the Exhibition.

Art. 62.—An International Jury for making the awards will be formed, divided into nine groups, corresponding with the nine groups of the products of agriculture and industry enumerated in the system of classification. (Art. 11.) The number, the nature, and the various grades of the awards, as well as the constitution and functions of the jury whose duty it will be to apportion them, will be published hereafter.

Art. 63.—The objects will be studied and experiments conducted under the direction of the members of the jury, and of a scientific, agricultural, and industrial commission, appointed by the Imperial Commission.

Art. 65.—Immediately after the close of the Exhibition the exhibitors must begin to pack and remove their goods and fittings. This operation must be completed before the 30th of November, 1867. After that date, the goods, cases, and fittings which may not have been taken away by the exhibitors or their agents will be removed and deposited in a public warehouse at the cost and risk of the exhibitors. The objects which by the 30th of June, 1868, may not have been removed from that warehouse will be publicly sold, and the net proceeds of the sale will be applied to some work of charity.

The following is the form of application for space:—

Committee of Council on Education.—Science and Art Department, South Kensington Museum.—No. 4.—Demand for Space.

Name and Christian Name of Applicant,
or Name of Firm..............................
Nature of Business carried on..................
Address—
No., street, or square ....
Name of town ....
Nature of goods to be exhibited................
Space the applicant is prepared to occupy—
Length ... feet. Breadth ... feet. Height ... feet.
Remarks—

It is requested that this return, when filled up, may be forwarded not later than the 28th February, 1866, addressed to "The Secretary," South Kensington Museum. "Paris Exhibition, 1867," in the corner.

Fine Arts.

Bordeaux Society of Fine Arts.—The Société des Amis des Arts of Bourdeaux has just published the report of its fourteenth exhibition. The number of works exhibited amounted to 547, of which all but forty were sold. 163 of those sold realised more than £3,000. The exhibition was so well attended that the time of its duration was extended nearly two months. Of the purchases, two paintings and four bronzes were acquired for the museum of the town. The society bought fifty-three works for a sum total of nearly £900; these were distributed amongst its members by lot. The rest of the purchases were made by private persons. The total sums expended for works of art at the fourteen exhibitions of the society amount to nearly £25,000. The receipts of the society exhibit a regular annual increase; the number of subscriptions amounted this year to more than £900, and the whole expenses, including the carriage of the works exhibited, to no more than £360. The Emperor, the General Council of the Department, and the Municipal Council contribute to the exhibition.

Two Pictures by Rubens.—Two important works of this great master, which have been lost sight of for some time, are now in the hands of an amateur in Paris. One represents St. Veronica, the other the regency of Marie de Medicis. The former was executed in Italy, and the Venetians and the Romans both claim the inspiration, as regards style, for their schools; of this picture M. Auguste Conder, of the French Institute, says:—"I have never seen a picture which expresses poignant grief more eloquently. What poetry, what colour, what effect of light, what marvellous gradations of tints! The head of Christ has such an expression of suppressed sorrow and resignation that one cannot avoid being profoundly affected by it." The other picture was executed for the Gallery of the Luxembourg, and its abstraction is not accounted for. Marie de Medicis has one foot in a boat, which represents France; her left hand holds an oar, while her right is in that of Minerva; the goddess tramples under foot old Silenus, who here represents the passions of the multitude. On the right of Minerva is Mercury, with one knee on Silenus, and the right arm supports a horn of abundance, and his left the crown and sceptre of France. Zephyr seizes a butterfly, symbol of pleasure and thoughtlessness. Above is Cupid, who holds a laurel crown in one hand and a palm branch in the other. The drawing and colouring of the picture resemble those of Titian, with the exception of the figure of Silenus, which recals the style of Giorgione. The Venetian critic has said of this picture:—"The allegory of Marie de Medicis, in four principal figures, is of such remarkable beauty, that the composition may be called a poem in painting, to such an extent has the great Rubens shown himself a painter-poet in this picture." The discovery of two such works is an important event.

Commerce.

Cotton and Wine in Algeria.—A report by Consul-General Churchill says that in 1863, 7,455 acres of land were sown with cotton in Algeria, and the produce was 3,548,360 lbs., of which upwards of three millions were produced in the province of Oran, which appears to be better suited for this particular cultivation than Algiers or Constantine. The French government is making great efforts to increase its growth, and is granting a premium on the exportation of native cotton, calculated to allow the cultivator a reasonable profit. Without such a premium, even with the actual high prices, cotton could not be grown cheap enough. The expense attending the cultivation of cotton in Algeria is on an average £16 per acre for the first year, when the soil has to be prepared for this particular kind of cultivation, and £9 12s. per acre the following years. In 1863 eleven twelfths of the cotton produced in the province of Algiers was Georgian long thread, and the remainder Louisiana short thread. But it appears that there is an objection to Algerian cotton, arising from its being generally badly sorted and cleaned, and the fibre is, moreover, knotty and deficient in strength. The cause of this last defect is supposed to proceed from the fact of the produce being ginned before sufficient time has been given it to ripen. The best qualities of the crop of 1863 were sold at Algiers at the rate of £5 16s. the cwt. of unginned cotton. In 1861, 13,745 acres of land were cultivated with the vine, and produced 3,835 tuns of wine. In 1862, 16,062 acres were under cultivation, yielding 4,529 tuns of wine, besides 20 millions of pounds of grapes. The wine produced is as yet, however, of an inferior quality. Its flavour is not unlike that of the sweet wines of Spain and Portugal, and it is very heady.

Maize Sugar.—Monsieur B. Dureau, the editor of the *Journal des Fabricants de Sucre*, gives the following account of the attempts that have been made in France to extract sugar from maize:—"At the time of the continental blockade, when we were at war with England, and when France and a considerable portion of Europe besides was deprived of colonial produce, attempts were made to undertake on a grand scale the manufacture of grape sugar, and experiments were made with different plants in order to obtain sugar: the maize was one of these, and Parmentier pursued his researches in order to extract sugar from it: this, however, he only succeeded in doing in the form of non-crystallisable syrup. These researches are set forth in his work on the 'Manufacture of Syrups,' which bears the date of 1813. Ten years later, Marabelli, of Pavia, extracted sugar from the maize; then came Burget, Deyeux, Pictet (1811), Dr. Neuhold, Pallas (1824), Biot, and Sobeiran. But no part of these experi-

ments, so far as I have read, established the fact that a really crystallisable sugar could be made from maize; syrup only was extracted. In 1842, some experiments were made in Louisiana, which clearly proved that the sugar corn contained a large portion of crystallisable sugar, but I am not aware that they succeeded in practically obtaining any quantity. The extraction of sugar seems to present great difficulties. Nevertheless, M. Neuhold succeeded in extracting about 70 or 71 litres of juice from 1,000 maize stems; and from this he has extracted 12 lbs. of good syrup, and this again furnished him with 3½ lbs. of crystallised sugar, and 8½ lbs. of molasses. Whether this product deserved the name of crystallisable sugar, and whether it could stand a comparison with that which we get from the cane, I do not know. M. Lapanouse has repeated Neuhold's experiments, and from 100 lbs. of canes extracted about 9 or 10 lbs. of good syrup. M. Pallas could only get 360 grammes of syrup from 7 kilogrammes of maize cane—about a fourteenth part. That maize contains a considerable amount of sugar is evident, but at what particular period in the growth of the plant the sugar is crystallisable, and what quantity can be practically extracted from it, is the important point not yet resolved."

Tea in Ceylon,—It appears that the cultivation of tea has been tried to some slight extent in Ceylon, and there seems to be no doubt that it can grow tea as well as Southern India or Assam. It is possible that in the course of a few years a fresh source of supply may be added to the numerous places of production which of late have contributed to swell our imports. At present the planters of Ceylon appear almost dependent on the cultivation of coffee.

Zante Petroleum.—A company has been formed for developing a valuable petroleum property in Zante, one of the Ionian islands. There are two valuable springs of it, which, there is good reason to believe, have yielded this product for more than 2,000 years. The historian Herodotus referred to these oil springs in the following terms:—"I myself have seen pitch drawn up out of the water from a lake in Zacynthus (Zante). At the place I speak of there are a number of lakes, but one is larger than the rest, being 70 feet every way, and two fathoms in depth. Here they let down a pole into the water, with a bundle of myrtle tied to one end, and when they raise it again there is pitch sticking to the myrtle, which in smell is like to bitumen, but in all else is better than the pitch of Pieria. (Note by Rawlinson—"The pitch of Pieria was considered the best in Greece.") This they pour into a trench dug by the lake's side, and when a good deal has been got together, they draw it off and put it up in jars." (Rawlinson's Translation, Book 4, Chapter 195.) Rawlinson adds "Zante still produces large quantities of mineral pitch." Dr. Chandler, writing before petroleum was known as an article of commerce, thus describes the "tar springs," as he calls them, of Zante:—"The tar is produced in a small valley about two hours from the town, by the sea, and encompassed with mountains, except towards the bay. The spring which is most distant and apt for inspection rises on the further side, near the foot of the hill. The well is circular and four or five feet in diameter. A shining film-like oil mixed with scum swims on the top; you remove this with a bough and see the tar at the bottom, three or four feet below the surface. * * * * We filled some vessels with tar, by letting it trickle into them from the boughs which we immersed, and this is the method used to gather it into pits, where it is hardened by the sun, to be barrelled when the quantity is sufficient. (Chandler's Travels, vol. 2.) The demand in Europe for petroleum, both for lubricating and lighting purposes, is rapidly increasing, as appears from the following quantities imported into Europe from the United States during the last four years, viz.:—1,194,682 gallons in 1861; 10,887,701 in 1862; 28,161,191 in 1863; 31,787,951 in 1864. Dr. Paul, in his report, states that as much as five barrels a day may be collected from these wells, and Dr. John Davy, who visited the wells in 1824, states that one hundred barrels had been collected in one year. These estimates may both be far from the actual yield, since the material has hitherto been collected only at times when it happened to be wanted; but, without special arrangements for gauging the daily flow of petroleum from the wells, and without precise observations, extending over some time, it would be impossible to form a more accurate estimate as to the quantity of the spontaneous exudation. It is important, however, to remember that this exudation is to be regarded only as the index of a subterranean store of petroleum, and that it is certainly much more considerable than has been observed in the case of other abundant sources of petroleum, such as those of America, for instance, where the indications of the existence of petroleum consisted merely in the greasy character of the water from springs, or the presence of a film of oil on the surface of stagnant water in the neighbourhood. Another circumstance connected with this exudation in Zante appears to be highly significant of the existence of a considerable subterranean source of supply. This is the very great length of time during which the large spontaneous flow above referred to has continued without any artificial aid. Thus the description of the wells, given by Herodotus more than 2,000 years ago, from his observation of them, is almost equally applicable at the present time.

Colonies.

Agriculture in Victoria.—The Legislative Council has published a return that throws some light on the disputed point as to whether the agricultural or the pastoral produce was of the greater value to the colony of Victoria. The returns show that the number of acres occupied by farmers in 1864 was 2,697,981, and by squatters, 31,683,306. The value of the agricultural produce raised in that year was £3,676,250, and of the produce raised by the squatters, £3,316,793. Thus the farmers raised a greater amount of produce than the squatters, and from less than a tenth part of the land, the year having also been a most unfavourable one for the farmers, as owing to a failure of the crops the yield of wheat was less than half of an average. The total number of persons engaged in agricultural pursuits, both male and female, was 41,218, and in pastoral pursuits, 9,724. The value of machinery used by the farmers, including one steam-plough and one steam-engine used for irrigation, reaping and threshing-machines, &c., was calculated to be about £129,960, whilst the number of men in attendance on these machines was almost equal to the number employed by the squatters for all purposes. To the above amount of £3,676,250 should be added £1,136,716, the declared value of flour, wheat, &c., imported, to show the quantities required for the annual consumption of the colony.

Kerosene in New South Wales.—The discovery in this colony of mineral shale, producing kerosene oil, is more extensive than is generally supposed. A kerosine and paraffine oil company has already been established, and numerous truck-loads of their raw material are forwarded by rail to Sydney. The district of the Hartley appears to be very rich in this mineral. The examinations and experiments that have been made are said to justify very sanguine expectations. The extensive use of this shale in the manufacture of gas will improve its quality.

Timber Trade in West Australia.—This trade is progressing favourably; all the stations are fully engaged in cutting timber, large orders having been received for exportation to South Australia, Calcutta, and Bombay. There appears to be ample encouragement for a great extension of cutting operations, and it is expected that the timber trade of this colony will greatly increase.

British Property in Victoria.—The Custom-house returns show that four-fifths of the ships annually fre-

quenting Port Philip are the property of British owners, and that of their total estimated value, £4,770,000, £4,000,000 represents the interest that British merchants have in them. The cargoes brought by these ships from the United Kingdom and from British possessions are valued at £10,000,000, and the colonial produce they take away, consisting chiefly of gold and wool, is worth £9,750,000. Both the ships and cargoes are for the most part insured in British offices. The property of the banking and other financial institutions in Victoria is estimated at £10,000,000, and £8,000,000 of this amount may be said to represent British capital, whilst the stocks of British merchandise stored in the Melbourne warehouses are seldom of less value than £5,000,000—about sufficient for six months' consumption. It is feared that the clip of wool will be unusually light this season, the sheep having suffered much from scarcity of food; and the result of the lambing season is not satisfactory.

Publications Issued.

À RICHARD COBDEN. (Paris; folio.)—This volume is a splendid testimonial to the memory of Richard Cobden, furnished by several of his most intimate friends in France. The introduction is by M. Emile de Girardin, who sketches the services of Mr. Cobden during the last quarter of a century. M. Michel Chevalier contributes a long and minute biography of his late friend; and M. Castagnary has collected and arranged the expressions of sympathy which issued on the receipt of the sad news of Cobden's death from the press, the tribune, and the official world, including an autograph letter from the Emperor and one from Prince Napoleon. The volume is illustrated by a fine portrait of Mr. Cobden, and a figurative frontispiece. The Imperial letters, the biography by M. Michel Chevalier, and a long letter addressed to the latter by Mr. Cobden, are all printed in *fac-simile*, and the whole is executed with the greatest care, and printed on the finest paper. It is a memorial which the family of Richard Cobden must regard with deep though melancholy satisfaction. It is not often that one country pays such a tribute to the memory of the son of another.

LE PARTHENON. By M. Marchal. (Paris.)—M. Marchal, the author of an interesting book of travels in Senegal and China, has published at once a reproach and an appeal to the nations of Europe in favour of the artistic remains of ancient Greece. He complains not only that we despoil the classic land of the finest remains of her former glory, but that we do not aid her in preserving, and, as far as possible, reconstructing the temple raised by Pericles to "Human wisdom, personified in Minerva." It appears that some persons have conceived the idea of converting the Parthenon into a dancing hall, and against such profanation M. Marchal protests energetically, and in this protest assuredly all lovers of art and all elevated minds will cordially join; but if the government of Greece cannot protect the monuments of her own glory, there is not much probability of other nations doing for her what she does not exhibit an inclination to do for herself. On the other hand, the manifestation of a desire to preserve the Parthenon and other ruins would doubtless soon induce others to aid in the work.

GUIDE THEORIQUE ET PRATIQUE DE L'AMATEUR DE TABLEAUX. By T. Lejeune. (Paris. 8vo.)—The appearance of the first and second volumes of this work was noticed in the *Journal* of the 9th of December last. The third and concluding volume has recently been issued. It contains an alphabetical list of the painters of all schools, from the earliest period to the present time, about nine thousand in all, with the place and dates of birth and death, sales with prices of important pictures, and other information not included in the body of the work. The remainder of the volume is occupied by an alphabetical list of signatures, monograms, and marks of artists, executed in *fac-simile*, probably the most complete yet published. M. Lejeune had peculiar advantages in the construction of this table; he is one of a family of artists and collectors well known in the arts for a century, and the present list is the result of the labour of his predecessors, enlarged and corrected by himself during his long experience as restorer of pictures in the Imperial galleries of France, and as conservator of several very important galleries, including those of Duchâtel, Fould, de Morny, and Soult, and from his researches abroad. As an instance of the corrections may be mentioned that of the name of a well-known artist, which has usually been written Memling, but which M. Lejeune clearly shows to have been Hemling, the error having arisen from a peculiar form adopted by that painter for the initial letter of his name. The careful execution of the blocks of these monograms and signatures gives great value to the work.

Notes.

PARIS EXHIBITION OF INSECTS.—This curious exhibition has attracted the attention of men of science and agriculturists, but most particularly of those who are interested in the rearing of bees and silk worms, which naturally occupy the chief places. The collection of bee-hives, some shown in operation, and of other matters connected with the rearing and management of these interesting insects, is considerable, and presents forms, in some instances, strange to English eyes. In addition to the bees themselves and the material referred to, are specimens of their products and of the articles into which they enter, such as honey, wax, mead or hydromel, sweetmeats, and confectionary. The largest portion of the exhibition, however, was occupied by matters connected with the production of silk. An admirably arranged collection was shown by M. Jules Rieu, of Valréas, in the department of Vaucluse, including the white and yellow cocoons of the Japanese silk worms, introduced into France in 1863, and extensively bred by M. Rieu; green cocoons also from Japan, introduced in the present year; silk spun from these various cocoons; models of the frames and other material used in the silk cultivation; and specimens of the insects themselves in the various stages of their existence. M. Guerin-Meneville, M. H. Givelet, and others, exhibited numbers of the *Bombyx cynthia*, and of other worms produced by the crossing of the former with the *Bombyx arrindia*, feeding on the leaves of the ailanthus, and also several chambers containing cocoons and hundreds of enormous moths depositing their eggs. Others show products, preparations and sketches of the *Bombyx yama mai*, a very large green worm that feeds on the oak, and of many other new and curious species. But the ailanthus worm seems to have attracted the greatest attention, and its cultivation, as already stated in the *Journal*, is rapidly extending. M. Givelet, who published a report on the subject not long since, read a paper at the exhibition some time since, and promises a more complete account of the best method of bringing this worm into cultivation on a large scale during the coming winter. This gentleman commenced planting the ailanthus at the Chateau of Flamboin in 1860, and, after some misfortunes and disappointments, completely succeeded in the breeding and rearing of the worms. He reports that during the present season he has collected about twenty thousand cocoons, and that about three times that number are now on the trees in his plantation. The museum of Natural History, at the *Jardin des Plantes*, contributed a fine collection of insects, with specimens of timber and other substances which have suffered from their ravages; also some remarkably large specimens of lobsters, and crayfish from American waters. Another remarkable collection of insects is from Mr. T. Glover, the entomologist attached to the Department of

Agriculture at Washington. M. E. Mocquerys, of Evreux, has an admirable exhibition of coleopterous and other insects which feed on the vine, cereals, and other industrial plants. Dr. Eugène Robert contributed a series of sections of trees ravaged by xylophargous insects, together with illustrations of the methods which have been adopted by the authorities of Paris and other places, under his superintendence, for their destruction. There were other collections of more or less importance, and, amongst the curiosities of the exhibition, a landscape produced entirely by the arrangement of various coloured beetles. Apparatus and powders for getting rid of certain classes of noxious insects were numerous in the exhibition, amongst which, judging from the number of medals and awards granted to the discoverer, the powder produced from the flowers of the *Pyrethrum Willemoti* seems to hold the highest place. It appears that the flowers of various plants of this family are extensively used in Persia, Armenia, and other countries, for like purposes. The Persian powder is said to be composed chiefly of the flowers of the *Pyrethrum carneum*, while the Armenians prefer the *Pyrethrum roseum*.

Great Aqueduct.—The conveyance of the waters of the river Dhuis to Paris ranks amongst the most important public works of its class, and, being just completed, a short account of the undertaking will not be uninteresting. The object is the increase in the supply of the amount of water for the consumption of Paris, and especially that of the higher levels of the city. The aqueduct of the Dhuis, or Dhuys, commences at Pargny, in the Aisne, and traverses the departments of the Seine-et-Marne, Seine-et-Oise, and Seine, its total length being about 135 kilomètres, or upwards of eighty English miles; the whole is constructed in solid masonry, with a fall of about seven inches in the mile, with the exception of about nine or ten miles, where the waters are carried through valleys by means of cast-iron syphon pipes, fifty-five inches in diameter, and having an average inclination of rather more than thirteen inches to the mile. The stone aqueduct lies underground throughout about six miles of its course, four of the principal tunnels being from eight hundred to upwards of two thousand yards in length. Four of the syphons are from a thousand to nearly five thousand yards long. The aqueduct was commenced in June, 1863, and completed last month, and the total cost, including indemnities to the proprietors of land, is said to have amounted to between £600,000 and £700,000. In the afternoon of the eleventh of the present month, the waters of the Dhuis arrived at the entrance to the great reservoirs of Menilmontant, described in the *Journal* of March 10th and April 21st; and in a few days, when the aqueduct and syphons are completely cleansed by allowing the water to pass directly through them into the sewers, the reservoirs will be filled and the service commenced. The Dhuis aqueduct is calculated to furnish about 40,000 cubic mètres of water in twenty-four hours, and that of the Marne with other supplies now brought to Paris, about four times that quantity, or 200,000 cubic mètres in all per day. Some idea of the magnitude of these works may be formed from the fact that the stopcocks or valves which close the main supply-pipes at their junction with the reservoir weigh more than four tons each. The pipes themselves are more than thirty-nine inches in diameter, and the valve or stopcock consists of a disc of cast-iron, which is set in the direction of the length of the pipe, or transversely, according as the water is to be turned on or off.

Patents.

From Commissioners of Patents Journal, September 22nd.

Grants of Provisional Protection.

Agricultural implements, propelling—1618—V. Poitevin.
Blacksmiths' bellows—2152—J. Bowden.
Bobbins of machines, fixing the, on to their spindles—2250—J. Ward
Boiler and tea kettle bottoms—2237—M. Judge.
Boots, &c., elastic material for—2132—M. Cartwright and A. Dale.
Bottles, stopping—2246—W. T. Read.
Carriages, disengaging runaway horses from—2214—R. T. Holmes.
Copying presses—2186—G. Owen.
Cotton seeds, preparing, for crushing—2196—F. A. E. G. de Massas.
Crinolines, imitation embroidery for—2131—R. Clarke.
Fabrics and threads, washing—2126—R. A. Brooman.
Fire-arms and blasting, charges for—2266—C. Reichen.
Fire, &c., warning of—2064—C. West.
Fringes and trimmings, ornamentation of—2280—T. B. Bailey.
Hair brushing machinery—2278—J. Neat and F. Ford.
Horses, &c., shearing or clipping—2172—J. G. Tongue.
Ice safes—2244—H. C. Ash.
Iron—2018—E. Sabel.
Iron bridges, &c., constructing—2226—W. Brookes.
Light, production of—2184—E. A. Curley.
Paper pulp—2248—W. E. Newton.
Peat, treating—2219—H. Terrell and T. Don.
Railway carriages, brakes for—1431—J. X. J. Barbaix.
Railway carriages, couplings for—2082—R. D. Morgan.
Railway carriages, &c., coupling for—2268—S. R. Freeman and A. Grundy.
Railway trains, stopping or retarding—2154—W. Shakespear.
Rivets—1531—C. de Bergue.
Safes and strong rooms, metallic—2265—S. Chatwood.
Screws—2240—W. Carron.
Sewing machines, self-acting—2218—G. Zanni.
Shafts, lubricating—2288—W. Mycock.
Ships' bottoms, coating—2120—S. Parry.
Ships' fastenings, iron—2010—P. Cato.
Soap—2140—A. Watt.
Steam boilers, fixing and unfixing the tubes of—2284—S. Soutar.
Submarine telegraph cables—2088—H. R. Guy.
Submerged telegraph cables, recovering—2134—J. L. Clark.
Sulphide of iron from coal, separation of—2252—T. Lomas.
Tea and coffee pots and urns—1950—T. Brown.
Two-wheeled carriages, springs for—2242—W. George.
Windows, cleaning—2243—G. Smeaton.

Inventions with Complete Specifications Filed.

Feathering paddlewheel—2380—G. A. Keene.
Locomotive car—2344—J. P. Woodbury.
Windows—2349—S. Wales.

Patents Sealed.

563. F. McD. and D. Chalmers.
833. R. Lublinski.
835. J. Green.
863. J. Bruckshaw and W. S. Underhill.
864. F. le Roy.
874. A. D. Gascon.
876. F. A. Mocquard.
883. W. N. Wilson.
884. W. Irlam.
885. W. Brookes.
904. T. Cook.
964. J. Bethell.
1039. H. Bridson.
1040. C. Boschan, J. Bindtner, and W. Caffou.
1084. T. Whitehead & N. Nussey.
1445. W. Clark.
1641. G. Haseltine.

From Commissioners of Patents Journal, September 26th.

Patents Sealed.

616. T. Turton.
860. J. Rooke.
870. J. Millar and J. Laing.
871. J. C. C. Halkett.
875. F. Thomas.
877. R. Young and C. F. G. Glassford.
878. F. W. Webb.
880. E. Savage.
881. I. L. Pulvermacher.
886. R. C. Robinson.
887. E. and F. A. Leigh.
888. F. A. Leigh.
896. W. M. Neilson.
898. W. Savory.
899. W. Brookes.
900. A. A. Croll.

Patents on which the Stamp Duty of £50 has been Paid.

2580. H. R. Fanshawe.
2585. C. Mertens.
2613. T. Kennedy.

Patents on which the Stamp Duty of £100 has been paid.

2200. S. Stimpson.
2149. W. Richards.
2151. G. L. Turney.
2156. C. Hall.
2173. T. Britt.

Registered Designs.

Multum in Parvo Shaft Tug—September 14—4742—Charles Watson, 5, King-street, Portman-square.
Pipe Wrench—September 15—4743—W. Maiden, Waterloo, near Ashton-under-Lyne.
Spring Chimney Holder—September 20—4744—Edward Alex. Rippingille, 118, Holborn-hill.

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TABLE OF CONTENTS.

Proceedings of the Society.

CANTOR LECTURES.

"On some of the most important Chemical Discoveries made within the last Two Years." By Dr. F. Crace Calvert, F.R.S., F.C.S.

Lecture III.*

Delivered on Tuesday, the 18th of April, 1865.

On the Discoveries in Physiological Chemistry.

I intend in this lecture only to give you a general outline of some of the main facts connected with the phenomena of digestion and respiration, introducing as I proceed some of the most important chemical facts connected with that branch of science discovered or observed within the last two years. To enable you to appreciate more fully the importance of those discoveries, I shall divide my lecture under two principal heads:—First—the studying with you those facts which have a special reference to digestion and respiration; and secondly—those which have a more immediate connection with the human system in their direct action as therapeutic agents.

Digestion.—Man requires several varieties of food to maintain the health and strength of the body. One of the most important of these is atmospheric air, which is chiefly used to maintain the heat of the body so essential to vitality, by oxidising the various substances taken as food, or by oxidising the tissues which have been destroyed in the body by the wear and tear of life, and which, having fulfilled their functions, require to be removed, that new tissues may replace those which have disappeared.

The next class of food which man requires are fluids, which are chiefly represented by water, either pure or mixed with other substances, and which fulfil in the body two principal functions—that of carrying into the stomach and the intestines various nutritious elements which have been taken as food, and conveying them into the blood by endosmosis, or the force called by Mr. Thomas Graham, the master of the Mint, "diffusion."

The second purpose which liquids fulfil in the human system, is to remove from the blood those various substances which have been acted upon by the atmosphere, as above explained, or others which have been produced by the action of vitality, and which require also to be removed from the system to enable it to be in a normal state.

* Lecture II. will appear in a future number.

Again,—Man requires various mineral matters, but these must be of a peculiar nature, so as to render them fit to fulfil in the organism the different functions to which they are adapted. Thus we find that man requires soda, potash, lime, manganese, iron, chlorine, sulphuric acid, phosphoric acid, and other mineral elements of minor importance. No doubt that for man, as for plants, the nature and the relative proportions of the mineral matters entering into the food which he takes are most essential; for if in that food a sufficient amount of salts of soda were not present, one of the essential elements of blood would be wanting. If phosphate of lime is not supplied in due proportions, the frame-work of his body will suffer. The same may be said of the importance of carbonate of lime in the water which he takes as a beverage; and, therefore, it is yet a question to be solved by experience, whether the extremely pure water which is now introduced into several of our principal cities, such as Manchester, Glasgow, &c., so agreeable to the general feelings of the public, under the impression that it is pure water, and which confers such benefits on manufactures in general, will not, in course of time, prove detrimental to the health of the inhabitants, owing to its extreme purity, not containing carbonate of lime, which is so essential to the formation of bone in man and animals.

The fourth class of food that man requires may be called heat-producing or respiratory food. This food is chiefly assimilated and employed by him to maintain the heat of the body, through the action of the oxygen of the atmosphere, and which, being dissolved by the blood, circulates with it, and burns or oxidizes its carbon, converting it into carbonic acid. This class of food is mainly represented by starches, gums, sugars, oils, fatty matters, and several other substances, such as pectic acid, pectose, &c.

The fifth class of food is flesh or blood-forming food, which is employed in the system to replace the various animal tissues which have fulfilled their functions, and which are modified and altered by the action of the oxygen of the atmosphere as above explained, or are destroyed by the tear and wear of life, and which leave the system principally in some modified state, by means of the fluid taken as a beverage. This class of food is represented by fibrine, albumen, caseine, and other similar nitrogenated substances, which we find compose in a great measure flesh, blood, milk, and other similar foods.

As it is impossible for me, in the course of one lecture, to give you a correct idea of the chemical phenomena involved in the digestion of the five various classes of food to which I have referred, I must confine my observations to the digestion of the two last classes of food, namely,

the heat-producing foods, and the flesh or blood-forming ones. The blending of chemistry with animal physiology has thrown much light on the phenomena of digestion; in fact, until chemistry had investigated many of the actions which take place in the digestion of foods, much obscurity existed, and many empirical views were promulgated on these important and essential functions of life. But since chemistry has penetrated into this branch of science, it has brought to light many facts which could not be understood or satisfactorily explained until the chemical facts connected with digestion had been well studied, and much light thrown on the complicated phenomena.

Although I do not agree in the opinion entertained by some persons that the phenomena of digestion are purely due to chemical actions, on the other hand I am of opinion that they cannot be regarded as entirely due to the force called vitality. My opinion is that the phenomena of digestion are due to the simultaneous or successive actions of vital and chemical forces. Thus, for example, the secretion of the various fluids necessary for digestion is due to vitality, and the influence of the fluids secreted on the substances taken as foods is due to chemical action, or, in many instances, to actions not yet well understood, but which still come under the head of chemistry, namely, purely chemical fermentation. I understand by this term the peculiar conversion or unfolding which certain substances undergo by the presence or contact of minute quantities of other substances, such, for example, as the conversion of starch into dextrine and sugar under the action of the peculiar ferment called diastase, or the unfolding of amygdaline into hyduret of benzoil, prussic acid, &c., under the influence of a ferment called emulsine. But we must bear in mind that this class of fermentations are perfectly distinct from those which I described to you in the last lecture of my course delivered in 1864, which fermentations referred to those which are determined or produced in consequence of the development in the fluids of certain microscopic vegetables or animals which, by their peculiar mode of growth or life determined the changes which are observed in many vegetable and animal fluids when in a state of fermentation or putrefaction.

With these explanations I shall now proceed to state that there are five principal fluids which are essential to digestion, and which are secreted by various organs which participate in the actions which take place during digestion, and these are:—1, *Saliva*, which is secreted by certain glands in the mouth; 2, *Gastric juice*, secreted by the membranes of the stomach; 3, *Pancreatic juice*, secreted by a gland situated just beyond the outlet of the stomach; 4, *Bile*, secreted by the liver; 5, a *Gaseous medium*, called atmospheric air.

Let us now examine how and to what degree each of these fluids acts upon the two special classes, and which I have stated are blood and heat-forming foods.

Animal Food.—When meat, for example, is taken as a means of subsistence, although it is divided into small pieces by mastication, and gradually brought into the form of a ball, so as to pass with facility from the mouth into the stomach, still it undergoes no chemical change by the mixing or imbibition of the saliva. But when it arrives in the stomach, it meets here a very acrid fluid called gastric juice, the acidity of which is due, not to hydrochloric or acetic acids, as was formerly stated, and which are now attributed to indigestion, but to the presence of phosphate and lactate of lime, together with a little free lactic acid, which acid elements are essential not only to the action of the ferment called pepsine, but also facilitate its solution. This pepsine acts in a most remarkable manner, for a minute trace of it appears to have the power to liquefy, if I may so express myself, the solid substance called fibrine, and to alter its conditions. In fact, all the solid animal elements of food become fluid under the action of the gastric juice, and are transformed into the fluid mass which has received the name of albuminose or pectose. The animal matter so transformed is susceptible of being absorbed either by endosmosis or diffusion by the coats of the stomach, but the greatest part of it passes on into the small intestines, where it meets the bile, and where the acidity of the fluid is neutralized and it becomes alkaline owing to the alkaline state of the bile. This transformation of the acidity of the gastric juice into an alkaline character, is essentially owing to the fact that during its passage through the small intestines it is in a fit state to be absorbed by the mucus which coats those vessels of the human organism, and to come in contact with the blood, which is always in an alkaline condition. Further, we know that organic matter in an alkaline condition enters more rapidly into decay and decomposition, so that it is thus in a fit state to be rejected by the body. Therefore, in the digestion of animal matters, we may consider there is only one active fluid which participates in it, namely, gastric juice, pancreatic juice and the bile only acting as alkaline fluids to bring it into a proper state to be absorbed by the mucus, and to be carried by the blood into the torrent of circulation.

Here I must pause in my description of digestion to make you acquainted with some of the recent discoveries which tend to prove that gastric juice does not simply liquefy fibrine and caseine, but that it acts also on albumen in such a way as to modify its molecular condition, and thereby its chemical properties. If the albumen of an egg be injected into the jugular vein it passes unaltered to the blood, for it is found in the secretions of the kidneys; but if the same be injected into one of the ramifications of the portal vein, then it has to pass through the liver, and therefore through the torrent of the circulation of the blood, and it is then so modified that it becomes assimilated and cannot be traced in the secretions of the kidneys. It follows that albumen of the egg must undergo a molecular change to render it fit to become assimilated, and we may assume, therefore, that it experiences the same change in the stomach under the influence of the ferment, called pepsine. But I cannot conclude this part of my subject without calling your attention to some interesting researches lately published by Mr. Smee. Until the publication of those researches, although scientific men had assumed that there must be an identity between albumen, fibrine, and caseine, which are the chief elements representing animal food, still they had not been able to demonstrate their convertibility one into the other. Now Mr. Smee has accomplished that fact; or, in other words, has reversed the theory previously entertained as to what takes place during digestion; for he has established that fibrine, or the clot of blood; caseine, or the curd of milk; and albumen, the serum of blood, are convertible into one fluid, which he has called albumenose, or pectose. Mr. Smee has succeeded, I say, in reversing the problem, and has shown that albumen may be converted into fibrine, and probable caseine. To effect this interesting change he proceeds as follows:—He passes a current of pure oxygen gas through a solution of albumen of blood or egg, slightly acidulated with acetic acid, and at a temperature of blood heat, or of 98° to 100°, and after several hours a mass of fibrine appears, the production of which is facilitated by bringing into play the action of an electrical current. If instead of an acid solution of albumen, Mr. Smee employed a weak alkaline solution of the same substance, it became transformed into a peculiar substance which I described to you in my last year's lecture, under the name of chondine. But I would strongly recommend to all lovers of animal physiology to read the interesting papers which have been published by that gentleman in the Proceedings of the Royal Society, 1864 and 1865.

Fatty Matters.—Allow me now to have the pleasure of calling your attention to the modifications which fatty matters have to undergo when taken into the human system, before they are prepared for assimilation. Most physiologists maintain, at the present day, that these substances undergo a change during their retention in the

mouth or their passage into the stomach, but Dr. Marcet is of opinion that fatty matters undergo a certain modification during their passage from the mouth to the entrance of the small intestines. At all events, there can be no doubt, from the researches of some of the most eminent physiologists, that fatty matters undergo a most important change when they arrive in contact with the fluids secreted by the gland called the pancreas, which transforms them into an emulsion, but does not saponify them. The matters so emulsioned are then further acted upon by the bile, and finally are absorbed by the lacteal vessels, and carried into the circulation of the blood. It is the absorption of fatty matters by the lacteal vessels which deceived the physiologists of an earlier date, and led them to believe that that white substance was the absorption of the nutrient parts of food, to which they gave the name of chyle, and which, according to them, gradually became transformed into the element of blood. Fatty matters so absorbed and carried into the torrent of the circulation of the blood fulfil two purposes—either they are consumed through the oxidation of the oxygen contained in the air inspired, and thus they help to maintain the heat of the human body, or they are stored up with the view of supplying the elements necessary to the maintainance of the heat of the body, when, through disease, the body has ceased to take its ordinary external nourishment. In fact, we may consider these fatty matters to be to the body what the coal-fields of England are to its manufactures.

Another division of the heat-forming or respiratory foods is that to which I have already referred, and which includes starch, gum, and sugar, and the transformations which these peculiar substances, and especially starch, undergo in order to become assimilated. Allow me to claim your undivided attention to the facts which I am now going to bring forward. When bread, potatoes, or any amylaceous substance, arrives in the mouth, it gradually becomes mixed and saturated with saliva—1st, the saliva of mastication, which is secreted by the paroted glands, and serves only to coat the mass of food called the ball, and so facilitate its passage into the stomach; 2nd, the saliva which is secreted by the sub-maxillary glands, a thin, watery fluid, which acts chemically on the food, converting the insoluble starch into soluble elements called dextrine and sugar. The amilaceous substance thus acted on passes into the stomach without further action, but when it arrives in contact with the fluid secreted by the pancreatic glands, there it undergoes a complete change; for the pancreatic fluid, called by the Germans the intestinal saliva, completes the conversion into dextrine and sugar of such portions of the starch as have not been acted on by the saliva of the mouth. For both these fluids are alkaline, I mean the pancreatic fluid and the saliva from the sub-maxillary glands; for that secreted by the paroted glands is acid, and this explains why the saliva is always acid in the morning or before man has taken food. I say that these fluids are alkaline, and they contain a ferment called diastase—a ferment identical with that which exists in malt, and which converts in the brewer's vat his mash into a saccharine fluid, which ultimately becomes beer. The starch so converted into dextrine and sugar through the action of the diastase of the saliva and of pancreatic fluid is absorbed by the mucus of the small intestines, and conveyed by the small veins which line those organs into the *veina porta*, and thence into the liver. This important organ fulfils several functions. First, it secretes bile, an alkaline fluid, which, as we have seen, acts as a neutraliser of the acid fluids arriving from the stomach, converting them into an alkaline condition fit for decay. Secondly, it is an eliminating organ, for the bile appears to contain some of the elements which require to be removed from the blood, and which have been produced through the wear and tear of life. Further, it contains some of the elements of the colouring matter of blood, for the colour of bile and that of the blood appear to have a resemblance. But the most important substance which the liver contains is a peculiar ferment, discovered by M. Claude de Bernard, which has the power to transform the insoluble substance which he calls glycogen into a soluble one, namely sugar. Thus it would appear, from the researches of that eminent physiologist, that the amylaceous substances absorbed as food, and acted on as above explained, arrive by the *veina porta* in the liver, and there are stored until required by man to maintain the heat of his body and the phenomena of life. He has observed—and the results at which he has arrived have been confirmed by C. G. Lehmann, another eminent physiologist—that there is comparatively only a small amount of sugar in the blood when it passes into the liver by the *veina porta*, whilst the same blood, when it leaves the liver by the hepatic veins, contains a comparatively large quantity. Thus Lehmann has found that the quantity of sugar in the *veina porta* blood amounts to from 0·21 to 0·30, whilst in the hepatic veins the quantity is from 0·87 to 0·98; and that the hepatic blood so charged with sugar first passes into the right ventricle of the heart, then into the lungs, thence into the left ventricle of the heart, whence it is driven, by the contraction of that organ, into the torrent of circulation. I say "the torrent of circulation," and as perhaps few persons are aware with what rapidity blood circulates through the human system, it may be interesting to state that every time the heart contracts, about three ounces of blood are driven out, and as there are about sixty pulsations of the heart per minute, the consequence is, that the 33 lbs. of blood which is contained in the body of an adult passes through the whole of his system—lungs, heart, kidneys, liver, and even through the most minute capillary vessels—in the space of three minutes. The knowledge of this fact will explain how small quantities of matter coming in contact with the blood may produce a most injurious action on the system—how, for example, the smallest quantity of strychnine, curorine, prussic acid, and other such substances, can act upon the blood, modify its nature, and produce death in a few minutes.

The curious substance called glycogen by Claude de Bernard was extracted by him from liver, by the following process:—The liver of an animal recently killed was cut into thin slices and thrown into a small quantity of boiling water. The whole was allowed to boil for an hour, and was then submitted to pressure. A small quantity of fluid was obtained, which, when treated by alcohol, yielded a white flocculent precipitate, and this, when re-dissolved in water, and re-precipitated by alcohol, was then found to yield with iodine and other re-agents the characteristic properties of amylaceous substances. Although glycogen exists in larger quantities in the liver when man or an animal takes a large quantity of amylaceous substances as a part of food, still this substance is found in the livers of carnivorous animals, showing that under the force called vitality animal matters are susceptible of undergoing the chemical change which converts them into a substance similar to starch. But this glycogen gradually disappears from the blood as it passes from the hepatic veins into the heart, and lastly through the torrent of circulation, for the oxygen of the atmosphere rushes into the lungs by inspiration, gets into contact with the blood in the numberless cells composing them, and by its action upon the glycogen helps to convert it into water and carbonic acid gas, which are thrown out by expiration. Now, although this conversion of the glycogen proceeds during the whole of the circulation of the blood, still there can be no doubt that the greatest portion of it is converted into gaseous elements when it comes in contact with the oxygen of the air in the cellular tissues of the lungs, for much less glycogen is found in arterial blood than in that of the hepatic veins.

To smooth the pathway of the reader to the perfect understanding of the above statement, it is perhaps necessary to add that when the blood leaves the liver it travels

through the hepatic veins into the right ventricle of the heart; that by the contraction of that organ the venous blood is thrust into the lungs, where it comes in contact with the oxygen of the atmosphere, and is converted from the dark purple colour which characterises venous blood into a brilliant red coloured fluid, called arterial blood. Having undergone that change, it runs thence into the left ventricle of the heart, and having filled it, that organ contracts itself, and drives the blood with great force through the whole of the arterial system, and during its passage through the capillary vessels it gets converted gradually into venous blood, which reaches through the various veins the *veina porta*, and this conveys it to the liver. Thus we can perceive how the blood constantly flows in a circular motion through the whole of the human system. At all events, before proceeding with the few remarks I have to offer on respiration, and calling attention to recent discoveries which have been made in connection herewith, allow me to state that Lehmann has published the following data respecting the action of the liver on the various elements contained in the blood. He has found that there is much more fibrine in the *veina porta* than in the hepatic veins; that albumen is more abundant in the portal than in the hepatic veins; that fatty matters are in larger quantities in the portal than in the hepatic; that globullin, or the substance which represents the globules of blood, is in less quantity in the portal than in the hepatic; whilst the colouring matter, called hematozine, is in larger quantities in the portal than in the hepatic. This, according to Lehmann, explains why we find colouring matters in bile, which may be considered as modifications of the one existing in blood, and which are found only in that fluid.

Although it is impossible in a lecture like this to attempt to give a correct idea of all the phenomena connected with respiration, and all the data which bear upon that important function of life, I may be permitted to give a few data, which will enable you, I hope, to have a general idea of the present theory of respiration. Man inspires about thirty times a minute, and at each inspiration there rushes into his lungs about a pint and a-half of air, which penetrates into the myriads of cells composing the lungs, and comes in contact there with the blood, as above stated, which it converts from venous into arterial. At the same time a certain quantity of air, or oxygen, is dissolved, which not only effects the above conversion, but displaces from the venous blood a certain quantity of carbonic acid, which it contains. Thus it is found by experience that one hundred parts of air that man inspires, contains, in round numbers, 21 parts of oxygen; whilst the gases he expires are represented by 16 parts of oxygen, four parts of carbonic acid, and one part of oxygen which has been transformed into water, thus making up again the 21 parts of gaseous matter in the 100 which he inspired. But the production of this carbonic acid is chiefly caused by the action of the oxygen dissolved in the arterial blood during its passage and contact with the animal tissues and the glycogen existing in the capillary vessels; for it is there that we observe the change of blood from arterial to venous, the conversion from venous into arterial being, as above stated, in the lungs.

Several theories have been promulgated by chemists and physiologists as to how the oxygen acts to convert venous into arterial blood. Liebig assumed that the blood dissolved oxygen as water dissolves that gas and others; and he explains the greater solubility of oxygen in the blood than in water, by asserting, and that on experiment, that phosphate of soda, which exists in blood, facilitates the solution of oxygen in that fluid. Dumas states that it is the iron which exists as one of the elements of the colouring matter of blood, called, as above stated, hematosine, which fixes the oxygen in the arterial blood, and yields it again to various organic matters, either those originating from glycogen or those resulting from the wear and tear of life, and which may be considered as refuse matters which require to be removed from the system. The iron thus becomes deprived of its oxygen, and is ready to reabsorb a fresh quantity when it comes again in contact with the oxygen of the atmosphere in the lungs.

These theories do not appear, so far as I am aware, to have received the general sanction of physiologists; and I therefore deem it to be my duty to call your attention to some interesting optical researches, due to that eminent *savant*, Professor Stokes, of Cambridge. That gentleman has observed that when a small quantity of blood is mixed with water, and the whole poured into a small tube, and this, in its turn, placed in such a position as to allow a ray of light to pass through the blood solution, and that then the ray of light is made to pass through a prism, he finds that the spectrum so produced has undergone certain modifications, which consist in the fact that certain tints or colours of the spectrum have disappeared; and he, moreover, observes that these "bands of absorption," as he calls them, are characteristic, for they differ according as the blood placed with the water in the tube is arterial or venous, and so delicate is this mode of investigation that he can discern the slightest modifications which blood undergoes. In fact, I may state *en passant* that he has applied this mode of investigation to distinguish vegetable and animal matters, which, though having a great similitude, become distinguishable by the simple mode of applying optics to their investigation.

Coming back to blood, I may state that the researches of Professor Stokes on the action of oxidising agents on blood, have thrown much light on the phenomena connected with the conversion of venous into arterial blood. He has remarked that if arterial blood is shaken with an alkaline solution of sulphate of protoxide of iron, or protochloride of tin, it assumes the dark colour of venous blood, and that if he then agitates the same dark purple blood with air, it absorbs the oxygen, becomes oxidised, and, therefore, is converted into red arterial blood.

These facts, joined to many more which can be found in the proceedings of the Royal Society, for 1864, have led Professor Stokes to the conclusion that the colouring matter of blood is the real carrier of oxygen; that it absorbs oxygen and becomes scarlet; and that it yields its oxygen to organic substances during its circulation through the system, and becomes purple or venous blood. He has given to the colouring matter of blood the name of *cruorine*, and calls it purple or scarlet cruorine either as it exists in the veins or arteries.

I think it is useless to repeat here many facts connected with this subject, and which I brought to your notice in my last year's lectures.

Urine.—Having also dwelt in my last course at some length on the principal elements contained in this important secretion, I deem it my duty merely to call your attention to one or two facts of some immediate importance which have been published since then. One of these is due to Dr. Marcet, who has found in that secretion a substance which, until his investigations, had been unnoticed by chemists. I mean an amorphous or non-crystallizable acid, which he calls colloidic acid, from the circumstance that it cannot pass or diffuse itself through animal membranes. I may here mention that substances in general, according to the theory of Mr. Thomas Graham, the master of the Mint, may be divided into two classes, namely—those which crystallise, and which he calls crystalloids, and those which do not diffuse, and which he calls colloide, from the French word *colle*, or glue. M. E. Morin has also published some elaborate researches on the relative proportions of oxygen and carbonic acid in urine, and the following table will show you the influence which exercise has upon the combustion of organic matter through the oxygen conveyed in the blood by the cruorine of Professor Stokes, converting the organic matter into carbonic acid, for this gas is found, as you will see, more abundantly in the urine of man when in a state of activity than when in a state of repose:—

Gases in the Secretion of the Kidneys.

Quantities of Gases in 100 Parts of Urine.	Composition of the Gases.	Activity.	Repose.
From 2·62 to 3·61	Carbonic Acid ...	73·56	62·93
	Oxygen	1·65	1·89
	Nitrogen	24·79	35·18
		100·00	100·00

I wish now to invite your consideration for a few minutes to some interesting facts which have lately been published by Dr. H. Bence Jones, on the extraordinarily rapid absorption of certain substances into the animal system. He has observed that substances, such as lithium and rubidium will be found to have passed into the whole of the human system three or four hours after they have been administered, either as medicines or as a matter of experiment. In fact, he has found that the absorption is so complete that he has been able to detect their presence in the non-vascular textures of the body; and what enhances the interest of his researches is, that he employed, as a means of analysis, for the detection of these substances, the property which they have of communicating colour to flame, and therefore applied to their detection the spectroscope of Bunsen and Kirchoff.

Whilst on the subject of the rapidity of the absorption of matter by the body, I may state that a French physiologist has observed that certain saline matters, such as iodide of potassium, nitrate of potash, or acetate of morphia, will pass in a few seconds through the whole of the system. Thus he was able to detect the presence of iodide of potassium in the urine three minutes after it had been taken by the mouth. But certainly one of the most curious instances published of late respecting the absorption of organic matters in the system is that related by Dr. Letheby, and which tends to prove the correctness of statements which have been published in former times, that certain chemists or persons had a secret of producing poisons, the action of which only became manifest a long period after they had been administered. Thus, Dr. Letheby states, in a paper which you will find in the "Proceedings of the Royal Society," and which contains some of the facts which he gave in evidence at a coroner's inquest in London, that the death of a person ensued twelve months after he had taken the substance which cau ed death. A man engaged in a large chemical works in London had inspired, during his labours, a comparatively small quantity of a substance called nitro-benzine (now sold under the name of oil of bitter almonds, and used in large quantities for perfumery, and also for giving taste to various culinary preparations), and that this substance had gradually become converted into aniline (a substance now extensively used to produce colours, and also procurable from coal tar), and had been the cause of the death of the man.

I would invite all lovers of animal physiology to read with attention the researches of M. Claude de Bernard on the physiological action of curorine, or the active principle of the curore, or the poisonous mixture used by the Indians at Madagascar, and on the banks of the river Oronoco. These researches will be found in several articles published by him in the *Revue des Deux Mondes*, 1864; and, to excite your interest in reading the articles, I may state on his authority that the death which ensues by the injection into the blood of a trace of this poison may be considered as the most curious and distressing that can be conceived, and, he further states, that the physiological phenomena which are witnessed during the process of death may lead to the most beneficial application of the substance as a therapeutic agent.

Although time is pressing, I cannot part from you this evening without calling your attention to the fact that every day we are realising the cherished ideas of the alchemist, and of the medical men of the fifteenth and sixteenth centuries, who laboured, the one to extract from substances what they called the quintessence of them, and the other to apply what they supposed then to be such quintessences. From the imperfect state of science, chemistry included, at that time, they were unable to carry out what they conceived to be essential to arrive at a better and more enlightened treatment of disease. They perfectly felt that the extracts or infusions of the plants they had at their command had not a defined action in their treatment. All men of science know with what enthusiastic perseverance Paracelsus advocated the employment of quintessences; and, although in his enthusiastic mind he went so far as to pretend that he carried in the head of his cane the elixir of life, there is no doubt that he and his disciples left a germ, which has gradually grown to be a plant, and that the chemistry of the present day is gradually succeeding in extracting from plants their active principles. Although medical men were convinced of the utility of employing the active principles existing in plants, as quinine, cinchonine (from cinchona bark), morphine (from opium), &c., still we had not a correct idea of the various actions which these diverse alkaloids exerted on the system. We are, therefore, much indebted to M. Claude de Bernard for his admirable researches on the therapeutic action of the alkaloids of opium; and owing to his extensive physiological knowledge, as well as his perfect mode of carrying out his experiments, he has proved that we can class the action of the alkaloids of opium under three heads, as shown by the following table:—

The Alkaloids of Opium.

Soporific.	Convulsive.	Toxic.
Narceia.	Thebaia.	Thebaia.
Morphia.	Papaverine,	Codeia.
Codeia.	Narcotine.	Papaverine.
	Codeia.	Narceia.
Not Soporific.	Morphia.	Morphia.
Narcotine.	Narceia.	Narcotine.
Thebaia.		
Papaverine.		

These researches thoroughly prove the correctness of Paracelsus's views, showing that in the employment of opium due consideration should be given to the fact that in that opium there are various agents acting in a defined manner upon the organs of his the patient.

I cannot conclude this lecture without drawing your attention to several interesting papers which have been published by Dr. Polli, of Milan; Davanne, Rayer, and and Le Mare, of Paris, tending to prove that the source of many diseases, especially those a contagious nature, may be due to the sporules, or germs of certain animal or vegetable ferments which penetrate with the air into the system, coming in contact, as it does, with the blood in the lungs of man. The difference between the views of these gentlemen and those who preceded them is that formerly these statements were merely theoretical, whereas these gentlemen, by the aid of the powerful microscopic instruments now brought into use, have been able to trace the presence of vegetables or animals in blood either of animals or man affected with certain classes of disease. I may cite as an example the discovery in the blood of the carbuncle, of the presence of vitrios and bactherea. (Royer and Davanne.) These facts explain why these gentlemen have applied with such success the most powerful antiseptic agent yet known in the treatment of that disease, namely, carbolic acid, and there is no doubt in my mind that the spread of either scarlet fever, typhoid fever, cholera, or any diseases arising from the decay of blood or its decomposition is brought about by the introduction into the blood of certain ferments which completely alter the nature of that fluid, as in the case of the carbuncle and similar diseases. If these views are correct—and I think I

am justified in saying that they have the support at the present day of some of the most eminent men on the continent—the employment of carbolic acid, either to prevent the spread of, if not to cure these diseases, deserves the attention of the medical world.

PARIS UNIVERSAL EXHIBITION OF 1867.

The Minister of State, Vice-President of the Imperial Commission, has just issued the articles relative to the Scientific Commission referred to in the general scheme of the Commission.

Article 1.—An International Scientific Commission is established in connection with the Imperial Commission, and has for its objects:—

1. To point out the means by which the recent progress has been made in the sciences, the liberal and the ordinary arts.
2. To aid in the propagation of useful discoveries, and in inducing reforms in matters of international interest, such as the adoption of the same weights, measures, scientific units, &c.
3. To point out, by means of special publications, the results, of general utility, which may be derived from the Exhibition, and, if necessary, to take measures for their completion.

Art. 2.—The Scientific Commission to consist of natives of France, named by the Imperial Commission, and of foreigners nominated by various countries. These nominations will be duly announced from time to time.

Art. 3.—Scientific bodies, and, in general, those who interest themselves in the progress of the sciences and arts, are invited to submit to the Imperial Commission their advice on the means to be adopted and the questions to be examined.

Art. 4.—The members of the Scientific Commission will not be required to attend any periodical meeting. They may work out alone the subjects which they are charged to treat upon, and remit the result of their labours to the Imperial Commission in their own name. At the same time they may act in concert with their colleagues if they think fit.

Art. 5.—The memoirs and reports will be submitted to the Imperial Commission before the 1st of July, 1867, and published, if found advisable, by its authority. These memoirs and reports will together form the works of the Scientific Commission.

The preparatory works of the Exhibition have been commenced; a number of workmen are now engaged in forming the ground-work of the grand avenue, a hundred feet wide, which will traverse the entire space of the Champs de Mars, from the quai to the Ecole Militaire in the rear. The ground is also being prepared on the Quai de Javel for the railway which is to place the Exhibition in communication with the whole of the grand lines of France by means of the Chemin de Fer de Ceinture and the Auteuil line.

Amongst the various objects of interest which are mentioned as likely to be seen in that portion of the park around the building which is to be devoted to the French exhibitors, are:—Model farms of the various provinces, with their stables, cattle sheds, dairies, steam and other agricultural machinery, and apparatus for making bricks, tiles, and drain-pipes; distilleries of spirits, essences, and resins; a charcoal manufactory complete, with a shop for the sale of its productions; a complete photographic establishment, and a dark chamber for photometric experiments; a manufactory of perfumes, and principally of extracts from certain flowers, such as the jasmine and tuberose, which will be cultivated, if possible, in the park itself; a horizontal flour-mill, and establishments for producing bread and pastry for the supply of the Exhibition; an electric lighthouse, two hundred feet high, for illuminating the park at night; and a coast lighthouse of the first order; an establishment for the cupellation of lead, and the making of copper and leaden pipes; an iron and bronze foundry; a glass-house; and manufactories of white-lead, sodium, and other chemical products.

A special site is said to be reserved for an observatory, where astronomical and philosophical instruments will be exhibited in action, and another for a campanile tower, with clock and chimes. Several hothouses and conservatories, exhibiting various methods of construction and heating, and filled with exotic plants; kiosques, chalets, rustic houses, fountains, ornamental vases, and garden furniture of all kinds will be distributed about the grounds. Architecture and construction will be illustrated by specimens of the principal modes of building in stone, brick, pottery, imitation marble, cement, concrete, and wood. One exhibitor proposes to contribute trees and shrubs, ranging from one to six metres high, sufficient to form fifty-three clumps, to fill a total space of seven hundred square metres.

Such are a few of the promised attractions of the Universal Exhibition of 1867.

FRENCH INDUSTRIAL COLLEGE.

The *Union Centrale des Beaux Arts* of Paris, whose admirable exhibition is now open in the Palais de l'Industrie, has just determined upon the establishment of a great college for pupils in the industrial arts. The directors of the Union consider that in order to give sound education in art as applied to industry, something more is wanting than museums, libraries, and courses of lectures, however excellent and complete in themselves, and the first step has been taken to unite all the means of instruction in one great collegiate establishment.

A piece of ground, containing between fifteen and sixteen thousand square yards, has been secured in the immediate neighbourhood of the Faubourg Saint Antoine, the very centre of the manufacturing quarter of Paris. The new college to be raised on this spot is to afford accommodation for five hundred resident pupils, and the organisation will include all that is necessary for the study of industrial art in its various branches; it will be a great normal school for the training of designers and managers of artistic establishments. The society itself will occupy one wing of the building with its museums and library, and it is proposed that each division of the former shall be decorated in the style of that epoch of art of which its contents will form the illustration, and that, as far as possible, the books, drawings, engravings, and other matters relative to the period shall be placed in immediate proximity with that section of the museum to which they have special reference. The estimate sets apart a sum equal to £12,000 for the annual salaries of the professors, in order that the most able industrial artists may be induced to lend their aid in the training of the rising generation of art-workmen. An important feature in the plan is the establishment within the college of a certain number of *ateliers d'honneur*, which will be given, for life or otherwise, to eminent artists and art-workmen, whose example will best guide the hand, instruct the eye, and cultivate the taste of the pupils. It is proposed, amongst other things, to include a school of equitation in the establishment of the college, not only with the view of supplying the pupils with the means of a healthful exercise, but also of making the eye acquainted with the living model of the animal in its various movements; and to arrange the lecture theatre in such a manner that it may be used for dramatic representations, the pupils being at once the scene painters, costumiers, and actors, and thus becoming theoretically and practically acquainted with an important branch of industrial art.

It is not intended that the education of the college shall be gratuitous; on the contrary, the fees will be rather high; but it is proposed that the sons of working

men shall be admitted to the courses of study, as out-of-door pupils, on payment of three francs a month.

Modifications will doubtless be made in the scheme as now sketched, but there is little doubt that the proposed college will be established, and the *Union Centrale* may well be proud of being the first body which has thought of applying the principle of thorough collegiate education to industrial art.

It is worthy of remark that the project is quite independent of the government; the first idea is said to have been thrown out by M. Duruy, the Minister of Public Instruction, who is indefatigable in improving the means of education of every kind, but the initiative is due to M. Guichard, the President of the *Union Centrale*, who not only drew out the scheme of the new college, but, in conjunction with M. Sajou, another member of the direction of the society, supplied the funds for securing the land on which the building is to be erected. M. Guichard is an architect and decorative artist, and M. Sajou a modeller of upholstery, so that the new college springs directly from the class to which it is to be devoted.

Manufactures.

BRADFORD CHAMBER OF COMMERCE.—RUSSIAN TARIFF.—A special meeting of the Chamber of Commerce was held recently, at Bradford, for the purpose of meeting Mr. Michele, *attaché* to the British Embassy at St. Petersburg, who attended with patterns of Russian goods, similar to woollen and worsted fabrics manufactured in this district, upon which he desired to elicit the opinions of the chamber. H. W. Ripley, Esq., the president of the chamber, occupied the chair, and the other gentlemen present, besides Mr. Michele, were Mr. Alderman Mitchell, Mr. J. A. Unna, Mr. C. Stead, Mr. Jacob Behrens, and Mr. H. C. Churton, Mr. Hirst, of Leeds, and Messrs. Grierly and Jubb, of Batley. The President briefly introduced Mr. Michele, and stated that he had accompanied Mr. Lloyd, President of the Associated Chambers, and Mr. Goodman in their visit to the Moscow Exhibition. Mr. Michele, in introducing his patterns of goods to the notice of the meeting, said his principal object was to obtain as minute a report as possible of these goods, in order that, in the report he should have to submit to Earl Russell, he might make a comparison of the relative cost of the production of the two countries—Russia and England—because there were many arguments in favour of the reduction of the high rate of duty in Russia which might be deduced from such an inquiry. They would probably find that up to a certain point Russia produced qualities of goods with which foreign countries could not compete. On the other hand, the higher qualities were produced far cheaper and much better here. This might be an argument in favour of reducing the duties on those low qualities. Mr. Lloyd and Mr. Goodman had done good service in this direction—they had sown good seed, which, no doubt, in due time would germinate and bring forth fruit. Very probably within the next few years a considerable reduction in the Russian tariff would be made. There was great opposition on the part of the manufacturers. The Russian government were not absolutely opposed to the principles of free trade, but they had to defer to the opinion of the people they governed. Public opinion in that country had great weight at the present time, and the Russian government were afraid of committing themselves to any policy which might be condemned by large sections of the people. Therefore, this question would have to be agitated, and he had no doubt, with the aid of the press and by other means, it would ultimately be made manifest to the people of Russia that they had nothing to fear from competition, but that, on the contrary, their manufactures would be improved and wider markets created. Mr. Michele cited some of the protectionist arguments which were at present used in Russia, and said that by the diffusion of more enlightened economical views upon this question the result in a few years would no doubt be the gradual reduction of the Russian tariff. Her Majesty's government were quite ready at any favourable opportunity to exert their influence with the Russian government to bring about such a change in our commercial relations with Russia as would be conducive to the mutual advantage of the two countries. The gentlemen present formed themselves into a committee to examine the patterns of goods and report thereon.

Commerce.

THE INDIAN TEA TRADE.—This trade (says Travers' Circular) is still in its infancy, and though its prospects are far more satisfactory than those of Japan, there are still many difficulties to be overcome before it can reach the development of which it is capable. Although India is an old dependency, it is but a young colony; in fact, it is still in transition from one state to the other. The aboriginal inhabitants and the European settlers are in an anomalous position, mutually jealous of each other, and for the most part without any common interest or sympathies; and it is no easy task for the Government officials, brought up among the traditions of the old *regime* to accommodate themselves to the new state of things, and to observe a strict neutrality between the disputants. There is great room for improvement, also, in the regulations framed for the sale of waste land, suitable for the cultivation of tea; the present system appears to lead to great abuses, and to retard rather than to advance the object for which it was framed. But India possesses what Japan does not—a stable and enlightened Government; old traditions are gradually dying out, as fresh legislators, with independent ideas, are brought in to fill up the gaps which so frequently occur even in the ranks of civilians serving in a tropical climate; education is spreading rapidly among the natives, and already a more intelligent class of colonists is being attracted by the prospect of obtaining, in a few years, at small risk of health, and with comparatively little labour, a competence which the work of half a life-time spent in Europe might fail to secure. The Indian tea plantations only require time to mature, and the skill of a sufficient number of intelligent Europeans, backed by a good supply of native workmen to perform the heavier manual labour, and the result is certain. The great experience in tea cultivation which the Chinese enjoy, aided by their industry and business ability—qualities for which the natives of India are not remarkable—will probably always make China the largest tea-producing country of the world; but their feeble government, and the unlimited exactions of their rulers, will be found to be serious drawbacks in a competition with a country living under British rule, and India, possessing this advantage, cannot long continue to be far behind in the race.

COTTON CULTIVATION IN INDIA.—It appears, by the *Cotton Supply Reporter*, that the report of the Cotton Commissioner of the Bombay Presidency upon the distribution of American seed, and the means taken to extend the cultivation of the New Orleans variety, recently published by the Bombay Government, tends to explode the opinion so long and tenaciously held by those entrusted with the management of Indian affairs, that cotton of a quality to rank with American cannot be grown in India. The repeated recommendations of the Cotton Supply Association to promote and encourage the growth of this description of cotton in that country have more than once been met with the reply that the experiment had been tried and had failed, and that, therefore, it was useless to repeat it. In these papers their own officer shows to the Government that not only has there been success in Dharwar, as Mr. Shaw, to whose zealous and persevering

exertions that success is mainly attributable, has long since demonstrated, but in other districts also where similar exertions have been made. In Mysore, the ryots of their own accord have taken up the cultivation of American seed. In the North-west Provinces and the Punjaub, the Commissioner fully believes that the introduction of the New Orleans cotton from acclimatised Dharwar seed will be successful, and he is satisfied that the failure in Berar is only temporary, and is owing to the deterioration which the seed had undergone from having been shut up in the heated and close atmosphere of the ship's hold, and to lateness in sowing. "It is held to have been demonstrated in this Berar experiment that cotton of staple and colour which will always hold its place in the British market may be grown to a good profit by Indian ryots in Central India." The conclusion adopted is, that not only will the acclimatised American plant thrive in many districts of the Punjaub and North-west Provinces and elsewhere in India, but there is good ground to expect that "the home market will be extensively supplied" from those sources with this description of cotton. Our hope of India, though long deferred, is thus, it seems, to be realised at last. This much may at least be expected, that the representations and counsels so often urged upon those at the head of Indian affairs will now, thus corroborated, obtain a degree of attention which hitherto they have failed to command.

Colonies.

Sugar Cultivation in Queensland.—It seems now clearly proved that this class of cultivation has taken firm root in this colony, many thousand acres having been taken up for sugar-growing purposes, under the new regulations which grant a lease of any unoccupied Government land selected, at a very low figure, to actual cultivators, with a purchasing clause during any renewal or expiry of the lease, leaving the capital of the sugar-grower intact to further his business, and at the same time securing him the land as if he were a freeholder. There are tens of thousands of acres still available for sugar-growing.

Cotton in Queensland.—A considerable number of the cotton cultivators of this colony lately held a meeting to urge on the Government the necessity of continuing the cotton bonus regulations for a few years longer, and which there is every reason to expect will be done. The last season has fully proved the adaptability of the colony for growing cotton, the crop having proved a profitable one.

An Expedition has just started for the interior of the Australian continent. This time the object is not so much to obtain an acquaintance with the country—although that of course will be one of the results—as to solve the mystery of the life or death of Dr. Ludwig Leichardt, who, in 1848, started from the settled district of Queensland to endeavour to cross the continent to the Gulf of Carpentaria, and who has never yet been heard of. The mystery connected with his fate, commencing at this date, still remains to be cleared up after the elapse of 17 years. A subscription has been raised by the ladies' committee to the amount of £900. The Victorian and South Australian governments have contributed each £500; the Queensland government has given £1,000; the Sydney government intends to double private subscriptions. The party engaged to conduct the search consist of eleven persons, all accustomed to bush life, and mostly of middle age. None of them, however, except the leader and a surgeon, have been to previous explorations. They are accompanied by 14 camels and over 40 horses.

Intercolonial Exhibition at Melbourne.—The Legislative Assembly having assumed the desirability of intercolonial exhibitions of industry and art, steps will be taken to hold the first intercolonial exhibition in Melbourne during the ensuing year. A grant of £2,000 has been sanctioned by the colonial parliament; and, in order that ample time may be afforded to mechanics, artizans, and manufacturers to enter into competition, a royal commission will be appointed, and the conditions of the exhibition promulgated. The liberality of the Victorian government ought to receive such encouragement as will induce the colonies generally to participate in the advantages of the show, and remove those jealousies which, at the outset, are likely to operate against the scheme.

Obituary.

Thomas Winkworth.—Another of the few remaining links between the past and present in the history of the Society of Arts has been severed. Death has recently removed from the Council table one of the oldest and most tried friends of the Society. In 1822, Thomas Winkworth was elected a member of the Society of Arts, and from that time he never ceased to take an active interest in its work. Born in 1790, the son of the Rev. William Winkworth, at the age of sixteen he was apprenticed to a silk manufacturer in Spitalfields, and thus became intimately connected with the commercial interests of his country. After serving the usual period of apprenticeship, and being made a freeman of the Fishmongers' Company, he established himself as a manufacturer and merchant in the City of London in 1819. He purchased the freedom of the Weavers' Company, and soon became known and active among those who, some forty years back, took steps to free the silk trade from the restrictions under which it was at that time carried on. He also gave great attention to all that was being done about the same period to improve the mechanical appliances of the weaver. Having joined the Society of Arts, he soon evinced a lively interest in its proceedings—an interest which was ever increasing and progressing. From his first entrance into life as a manufacturer he desired to be free from all the antiquated forms and practices which restricted industry, believing that, as in fashion, so in the modes of carrying on industries, the public demand a constant change, not so much in the materials employed as in the method and form of applying them. This conviction led him to give much time and attention to the Society of Arts, and in any and every effort to render that body more vigorous, his active co-operation was always to be relied on. He was one of those who helped to remove the restriction which prevented the Society from rewarding inventions when patented, a restriction which was in force up to 1844. In 1846 he advocated with other members the incorporation of the Society by Royal Charter. He very early recognised the importance of giving to Industrial Exhibitions an international character, and never ceased to take an active interest in them. He acted as Juror, and reported on the International Exhibitions of 1851, 1855, and 1862, as well as those of Dublin in 1854, and Florence in 1860. Since 1862 he allied himself to the movement which has spread so rapidly among the working classes and created so many displays of their industry; at the time of his death he was both a trustee and guarantor of the North-East London Exhibition—now open. He was a warm advocate of all those measures which tended to improve the educational, social, and moral condition of the industrial classes. The members of the Society well know how constant an attendant and zealous a worker he was at the Society's meetings, and the *Journal* contains many evidences of his zeal and good wishes for the prosperity of the Society of Arts. He died on the 15th September, after a few hours' illness, at his residence in Canonbury, aged 75, and was interred at Highgate Cemetery, deeply regretted as an affectionate father, a sincere friend, and a useful and upright citizen.

JOSEPH F. B. CHARRIERE, one of the most celebrated surgical instrument makers in Europe, died recently. Science and humanity generally owe him a deep debt of gratitude for the immense improvements which he has made and induced in the art to which he devoted himself. M. Charrière was born at Fribourg, in Switzerland, in 1803, but he was apprenticed to a cutler in Paris; he was the founder of the establishment which he conducted to the day of his death. His instruments have earned him medals and recompenses at numberless exhibitions; he was made Chevalier of the Legion of Honour in 1844, and after the Great Exhibition of 1851 was raised to the grade of officer of the order.

Publications Issued.

LES OUVRIERS D'A PRESENT ET LA NOUVELLE ECONOMIE DU TRAVAIL. By M. Audiganne. (Paris. 8vo.)—An attempt, by an able writer, to indicate the various phases of the life of the working classes, and to show what influences are at work which may produce changes in the economy of labour. The labourer himself, the tools and machinery employed, and the principles of association, are naturally three main heads of the discourse. The author belongs to the liberal school of the economy of labour, but he does not commit himself to the announcement of any special theory for the future.

CODE INTERNATIONAL DE LA PROPRIETE INDUSTRIELLE, ARTISTIQUE, ET LITTERAIRE. By J. Pataille and A. Huguet. (Paris. 8vo.)—A collection of the conventions and regulations of European governments respecting patents, literary productions, the theatre, music, the fine arts, trade marks, and piracy, with an explanatory introduction.

ANNALES DE LA PROPRIETE INDUSTRIELLE, ARTISTIQUE, ET LITTERAIRE. By J. Pataille and other writers. (Paris. 8vo.)—The eleventh number of an annual publication, containing a large amount of important facts and opinions relative to artistic, literary, and industrial questions.

Notes.

TAPESTRIES AT HAMPTON COURT PALACE.—The removal of the miscellaneous portraits from one of the long galleries of this palace to the Cartoon Gallery has disclosed a fine series of decorative tapestries on the walls, which are of the latter part of the seventeenth century, and are well fitted to the room. It is to be hoped that Mr. Cowper will allow them to remain, being part of the original decorations of the building, and much more appropriate and decorous than a number of miscellaneous portraits hung without any classification.

CHEMICAL SCIENCE IN GERMANY.—Such is the appreciation of chemical science in Germany, that at the present time two large chemical laboratories, on the most complete scale, are in course of being erected in Berlin and Bonn, at the expense of the state. They will cost, it is said, about £75,000.

COMPOUND BRIDGE.—A new bridge, constructed over the Seine, between St. Cloud and Sèvres, has recently been opened for foot-passengers and vehicles. It is a compound bridge, for general traffic and also for the continuance of the Auteuil railway, which by its means will be carried almost to the gate of the Exhibition of 1867, and also placed in connection with the Chemin de Fer de Ceinture, which connects all the main lines of railway having termini in Paris. The bridge is a handsome, though simple structure, of five arches, about 360 or 370 feet long, and perfectly level, the banks being high at the spot where it crosses the Seine. The total width of the bridge is full 90 feet, and affords room for the railway viaduct, two carriage-roads, each twenty feet wide, and two broad footpaths. The viaduct occupies the centre of the bridge; it is about forty feet high above the carriage-ways on each side of it, and the walls of the arches of which it is composed, as well as of the viaduct beyond the bridge on either side of the river, are pierced throughout by two smaller arches, which will afford a double covered way for foot passengers for the distance of about a mile. The whole is built of stone, carefully dressed and finished, and presents a very elegant appearance.

POSTAGE STAMPS.—A proposal has been made to the Minister of Finance, by French merchants, for the issue of postage-stamps of the value of five, ten, and twenty francs each, to be used not only for the prepayment of heavy packets sent by post, but also for the discharge of small accounts. The existence of some such means of payment between England and France would be a great boon, and now that a system of post-office orders exists between France and Italy, there is some natural impatience on the subject. For the payment of sums too small for cheques no ready means exists, although the rapid growth of relations between England and France so much demands such an arrangement. It has been asserted that the idea of a stamp for prepayment of postage originated in France in the reign of Louis XIV., but in the absence of any proof of the fact, little attention was paid to the assertion. The following notice, said to have been issued in the month of August, 1653, has appeared in a French newspaper:—"On fait sçavoir, y est-il dit, à tous ceux qui voudront escrire d'un quartier de Paris en un autre, que leurs lettres, billets ou mémoires seront fidellement portés et dilligemment rendus à leur adresse, et qu'ils en auront promptement réponse, pourvu que, lorsqu'ils écriront, its mettent avec leurs lettres, un billet qui portera port payé, parce que l'on ne prendra point d'argent, lequel billet sera attaché à ladite lettre ou mis autour de la lettre ou passé dans la lettre, ou en telle autre manière qu'ils trouveront à propos, de telle sorte néanmoins que le commis le puisse voir et oster aysément. Chacun estant adverty que nulle lettre ni réponse ne sera portée, qu'il n'y aye avec icelle, un billet de port payé, dont la date sera remplie du jour et du mois qu'il sera envoyé, à quoy il ne faudra manquer, si l'on veut que la lettre soit portée. Le commis général qui sera au palais, vendra de ces billets de port payé à ceux qui en voudront avoir, pour le prix d'un sol marqué, et non plus, à peine de concussion; et chacun est adverty d'en acheter pour sa nécessité, le nombre qu'il lui plaira, afin que lorsqu'on voudra escrire, l'on ne manqne pas pour si peu de chose à faire ses affaires," with the following memorandum appended:—"Outre le billet de port payé, que l'on mettra sur cette lettre pour la faire partir, celuy qui escrira aura soing, s'il veut avoir réponse, d'envoyer un autre billet de port payé, enfermé dans sa lettre." The stamp, or rather ticket, as may be seen, from the above quotations, applied only to Paris, cost one "sol," or halfpenny, had to be purchased beforehand at the palace, might be fixed on or placed in the letter in any way, provided the clerks could see it, but required to have the day of the month when it was used marked upon it. Moreover, its use was rendered obligatory by the announcement in question. It was doubted whether this order had ever been carried into practice, but a letter addressed by M. Pelisson to Mdlle. de Scuderi, to which such a ticket had been attached, is said to be in the possession of M. Feuillet de Conches. At any rate it is clear that the system was soon abandoned, and that no method of payment by means of stamps or tickets was in use in France until the year 1849. In the following year the issue of stamps amounted to 21,523,175; in 1864 it was 382,655,450. The value of the annual augmentation since 1854 has varied between three and four millions of francs.

VINTAGE IN THE NEIGHBOURHOOD OF PARIS.—The vintage began in some parts of France as early as the middle of August, and nearly everywhere in the first week in the present month. It is not perhaps generally known that from seventy to eighty thousand casks of wine are produced annually in the district to the north of Paris, and of which Argenteuil is the centre. There

are about fifteen hundred vine growers in the locality in question. The vintage commenced on the 7th September, about nine thousand persons being engaged to aid in the gathering. The opening of the vintage is officially announced, and labourers, male and female, come from all parts to the little town of Argenteuil, where they camp in the streets for the night, roasting potatoes for their supper by bonfires, and singing and dancing till three in the morning, when the vine growers appear, engage as many hands as they require, and march off home, each at the head of their squad. The scene is one of the most extraordinary that can be witnessed when the narrow streets of Argenteuil are filled with ten thousand men, women, and youths, all determined to enjoy their annual *fête*. The great abundance of grapes, and the heat of the weather made the scene this year more noisy and more exciting than usual. It is calculated that the yield will reach nearly a hundred thousand pieces, or about six millions of gallons. In old times, when the crop was good, a cask was often filled for fifteen or twenty francs, say about three pence per gallon, but in 1855 the price had risen to considerably over a hundred francs. A hundred years ago the wine of Argenteuil was considered equal if not superior to Burgundy or Champagne; if that appreciation was a just one, the metropolitan grapes must have sadly deteriorated, or the products of the latter provinces greatly improved, unless indeed a great change has come over men's palates, for certainly at the present moment no one will drink the wine of Argenteuil if he can obtain any other.

Economic Railways.—In the *Journal* of the 7th of July last will be found an account of the measures adopted by the French Government for the extension of the railway system to the rural districts of the country, and of the economical arrangements connected with the plan. The realisation of the object in view depends, in some measure, on the adoption of light and efficient engines, and the government has recently purchased the free use of a locomotive designed by an engineer named Rarchaert, for the purpose of running on light rails, and passing over sharp curves and steep inclines. M. Rarchaert's engine, with tender and fuel, does not exceed twenty tons in weight, has four pairs of wheels, coupled, and will not require rails exceeding forty pounds in weight to the mètre. The pressure of each wheel would thus be equal to two tons and a half, while that of the locomotives in use on the great lines ranges between five and six and a half tons, and the rails themselves weigh from seventy to eighty pounds per mètre. The engine is said to be able to draw 640 tons, in addition to its own weight, on a level, 310 tons up an ascent of 5 in 1,000, and so on, to 74 tons on a gradient of 30 in 1,000; and, at a speed of from eighteen to twenty-four miles an hour, it will, according to the inventor, work safely on curves of a minimum radius of sixty mètres; and, therefore, by adopting gradients varying from 12 to 30 in 1,000, nearly all necessity for tunnels, viaducts, and embankments would be avoided. The inventor calculates that under his system the average cost of these local railways will not exceed 60,000 francs the kilomètre, or less than £4,000 per English mile.

Patents.

From Commissioners of Patents Journal, September 29th.

Grants of Provisional Protection.

Breech-loading fire-arms and cartridges—2345—F. W. Prince.
Cages and hoists, safety apparatus for—2383—J. C. Broadbent.
Cast-steel—2277—J. Grand.
Cotton wool, &c., combing—2164—G. Little.
Crucibles—1884—G. Nimmo.
Dry docks, floating—2387—E. Clark.
Effervescing drinks—2377—O. W. Joyce.
Electro-magnetism as a break power on railways—2238—E. Cowpe and D. Hancock.
Fire-arms—2275—J. Snider.
Flying toys—2208—H. A. Bonneville.
Gases made in smelting iron, separating dust from—2391—E. A. Cowper and C. W. Siemens.
Gun barrels, tubes for—2351—G. P. Harding.
Harrows, &c.—2331—J. Badger and J. H. Steff.
Hides, &c., splitting, shaving, and paring—2282—H. H. Doty.
Hydraulic break—2337—W. J. Murphy.
Hydro-carbon or paraffin oils, treatment of—2008—J. W. Perkins.
Hydropults and hydrostatic pumps—2305—J. Webster.
Iron—2347—W. Unwin.
Knitting cotton, winding—2311—H. Shanks.
Locomotive engines—2329—R. Aitken.
Metal articles, shaping—2371—J. H. Johnson.
Metals, casting—2401—D. Spink.
Mills for grinding—2264—W. Barford and T. Perkins.
Motive power, obtaining—1832—H. A. Dufrené.
Night lights—2367—F. Meyer and J. W. Freestone.
Perambulators, &c., canopies for—2389—H. Lloyd.
Pipes used for smoking—2325—C. A. McEvoy.
Projectiles—2281—A. V. Newton.
Pulleys—2333—G. Tangye and J. Jewsbury.
Railway breaks—2375—H. Henry.
Railways, signalling on—2309—J. Anderson.
Raisins, apparatus for stoning—2301—J. Askew.
Revolvers, breech-loading—2210—P. Polain.
Rivets—2355—J. Wakefield.
Save-alls—2369—H. A. Bonneville.
Ships and other vessels, propellers for—1645—C. Hook and A. Peace.
Shirts—2254—J. M. Carter.
Skates—2180—J. I. Barber.
Spinning frames—2343—A. V. Newton.
Steam boilers, preventing incrustation in—2272—J. Howard, W. Stafford, and W. P. McCallum.
Steam boilers, safety valve for—2323—H. Hackett, T. Wrigley, and E. Pearson.
Stone, cutting—2363—A. V. Newton.
Submarine telegraph cables—2341—J. O. C. Phillips.
Telegraph cables, submerging—2261—J. Sproul.
Telegraph cables, apparatus for laying—2262—K. J. Perceval.
Tobacco, cutting—2359—E. T. Read.
Type for printing, apparatus for "composing" or setting—2303—A. Mackie and J. P. Jones.
Vent pegs—2365—R. M. Lowne.
Watches, &c., winding-up—2274—R. A. Brooman.
Wearing apparel—2317—R. C. Newberry.
Weaving, looms for—2295—J. Smith.
Wheat, &c., mills for grinding—2399—J. Tye.
Windows, opening and closing—2319—J. Pennington.
Wool, &c., combing—2299—A. Morel.
Yarn cops, winding—2297—W. Oldham.

Inventions with Complete Specifications Filed.

Electric bells, &c., ringing—2421—W. Moseley.
Machinery, lubricating—2429—H. A. Bonneville.
Peat or turf for fuel, preparing—2436—T. V. Lee.

Patents Sealed.

722. N. N. Solly.	962. J. G. N. Alleyne.
906. J. and D. Swarbrick, B. and O. Swarbrick.	963. H. Simon.
907. L. Bridge.	971. F. R. Ensor.
908. J. Poole and T. Brown.	972. C. Esplin.
922. H. Lewis.	986. P. Hugon.
923. R. A. Brooman.	991. S. Smith and J. W. Jackson.
924. G. Burt.	1029. J. H. Johnson.
926. J. Kennan.	1038. J. Haworth.
928. A. W. Pearce.	1049. J. S. Bickford.
940. F. Brown.	1086. J. E. H. Andrew.
945. J. R. Wigham.	1108. J. Y. Betts.
948. A. and H. Illingworth.	1151. G. Davies.
949. W. Brookes.	1834. N. Jenkins.
950. C. Martin.	1909. W. S. Yates & A. Freeman.
951. R. Baynes.	1941. A. V. Newton.
954. W. Moody & W. J. Huband.	1958. W. E. Newton.

From Commissioners of Patents Journal, October 3rd.

Patents Sealed.

966. W. Teall, L. Lepaige, and E. T. Simpson.	1002. W. E. Gedge.
967. J. I. Darribet.	1007. G. Davies.
969. C. W. Lancaster.	1009. V. A. Prout.
970. E. Ritherdon.	1030. J. H. Johnson.
976. E. H. Newby.	1041. F. P. Warren.
987. A. Muir.	1055. A. Westhead.
989. E. Welch.	1120. H. E. Newton.
994. J. Brown.	1264. W. E. Newton.
995. H. Edmonds.	1881. H. E. Gilles.
	1923. M. B. Schumann.

Patents on which the Stamp Duty of £50 has been Paid.

2633. H. Hutchinson.	2646. J. Bucknall.
2645. H. Ellis.	2653. J. L. Hughes.
2677. T. Greenwood.	2729. J. B. Palser.
2824. J. B. Payne.	2736. H. A. Marinoni.
2950. F. E. Sickels.	

Patents on which the Stamp Duty of £100 has been Paid.

2195. H. Monier.	2306. G. T. Bousfield.
2183. J. J. Russell.	

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111th Session.] FRIDAY, OCTOBER 13, 1865. [No. 673. Vol. XIII.

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Proceedings of the Society.

CANTOR LECTURES.

"On some of the most important Chemical Discoveries made within the last Two Years." By Dr. F. Crace Calvert, F.R.S., F.C.S.

Lecture II.

Delivered on Tuesday, the 11th of April, 1865.

On the Discoveries in Chemistry applied to Arts and Manufactures.—(Continued.)

One of the most curious and important applications which have lately been made of chemistry to manufactures is that of coal gas as a means of obtaining intense heats. In fact, heats have been secured which far exceed those previously obtained by the combustion of coals and other carbonaceous matters.

To understand how this result has been effected, it is necessary that I should say a few words on the combustion of coal gas. When coal gas is ignited, the oxygen of the atmosphere first combines with the hydrogen of the hydro-carbons, either gaseous or sufficiently volatile to assume a gaseous form, so as to produce water. Whilst a part of the carbon of these hydro-carbons combines with the oxygen to produce carbonic acid, the other portions of carbon float in the mass of ignited gaseous matters, and reach a sufficient temperature to radiate light in all directions. It follows, therefore, that the richer the coal gas is in hydro-carbons, into the composition of which enters a large proportion of carbon, the more brilliant will be the flame.

This is beautifully illustrated by an invention which I have the pleasure of showing you through the kindness of the Rev. Mr. Bowditch, of Huddersfield, who has lent me one of the apparatuses which he has lately invented to increase the illuminating power of inferior coal gas, and which has been applied with success in the city of London by its learned officer of health, Dr. Letheby. It consists in the introduction of carburetted hydrogens, rich in carbon, into the flame of ordinary coal gas, thus enhancing in a marked degree its illuminating power. This apparatus consists of:—A gas-tight metallic vessel, which holds the hydrocarbons, and which has an inlet connected with a gas supply and an outlet connected with the burner. The gas in its course passes over the surface of the hydro-carbons. Being above the flame, the vessel and its contents become heated, and part of the latter is converted into vapour, which the passing gas carries with it to the burners to enrich the flame.

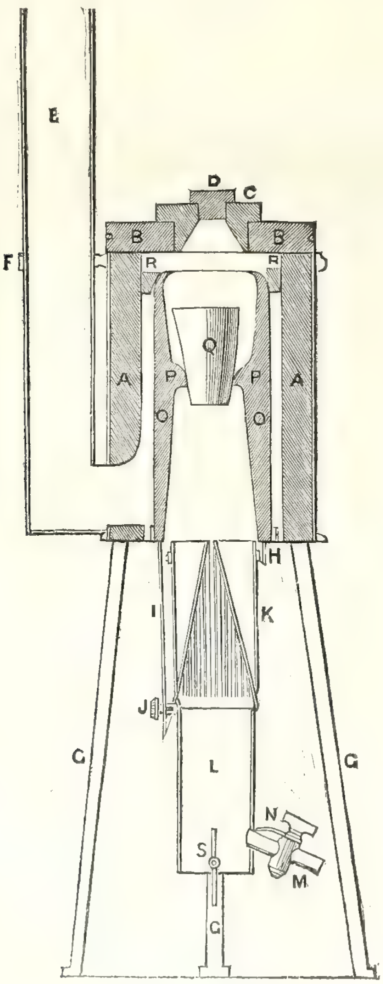
The following are the advantages which Mr. Bowditch's apparatus presents:—Common coal gas, Ashburton flat flame, fish-tail, and batwing, does not yield a light of 1·5 standard sperm candles per foot, though it yields the light of 2·4 candles per foot when burnt in a 15-hole argand with a 7-in. chimney. By adding 31·5 grains of naphthalin vapour to each foot of this gas the light-giving value is raised to between seven and eight candles per foot, according to the constitution of the gas with which the vapour is burnt. Oils do not yield quite so high a result as naphthalin, but they afford from 4·5 to 5 times the light given by gas alone. To show the economy of gas, I may cite the following results, given to me by Mr. Bowditch:—A gallon of oil, sold retail for 2s., is capable of producing, with 1,000 ft. of London gas, more light than is given by 4,000 ft. of gas, or 4s. 6d. gas and 2s. oil against 18s. gas alone. The hydrocarbon vessel requires charging about once in 14 to 16 days.

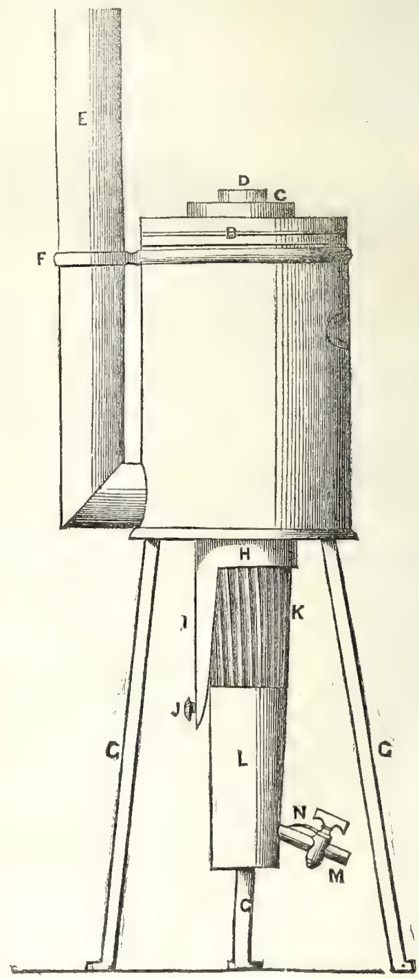
But let us now return to the production of intense heat by the combustion of coal gas. This is effected by burning gas with an excess of air, generally speaking, under pressure, so as to bring into contact in a given space of time a large quantity of gases, especially an excess of oxygen, with a view of rendering perfect combustion of coal gas. The first instance, to my knowledge, of the perfect combustion of coal gas as a commercial application, was its use in machines for singeing cotton and woollen fabrics, or for the purpose of removing from their surface all loose and useless fibres. One of the most perfect machines which I have yet examined for accomplishing this purpose has been lately introduced to the notice of manufacturers by Joshua Schofield and Sons, of Manchester. The great merit of their machine consists in the fact that by it they can vary either the intensity of the flame or its length according, to the pressure at which the gases in combustion are made to issue from the machine. In fact, they can adapt with such nicety the action of the machine to the nature of the fabrics they have to singe, that it can be applied to the finest fabric, such as cambrics, and to some of the heaviest materials in cotton, such as fustian.

The most remarkable example of the intense heat which can be obtained by the combustion of gases was brought into notice a few years since by that distinguished chemist M. H. St. Clair-Deville (the discoverer of aluminium), by which he succeeded not only in melting several metals which, until his experiments, had resisted all other modes of effecting their fusion, but in melting in his laboratory as much as 25lbs. of platinum, one of the most refractory metals known, and running it into one solid ingot. In 1862, the well-known metallurgists, Messrs. Johnson and Matthey,

vited to their works a large circle of the most scientific en of Europe, who were attending the Exhibition as rors, to witness the fusion of 220lbs. of platinum, and e running of it into one single solid ingot. This wonerful exploit in the production of heat was effected in a rnace similar in principle to that which had been devised y M. St. Clair-Deville, viz., in a furnace, the inner part f which was lined with blocks of quick lime, the only material found by M. Deville to be susceptible of resisting the intense heat which was produced by bringing at the upper part of the furnace a large jet of gas and air intimately mixed, and working under pressure. The flame, in passing from the upper part of the furnace and making its exit at the lower part, produced so great a heat as to melt the above stated quantity of platinum.

The observations of M. Deville soon brought into existence some extremely simple and handy furnaces to effect fusions and assays on a laboratory scale. Some of the best furnaces contrived for that purpose are due to Mr. J. J. Griffin, of Bunhill-row. The principal feature of his furnace is using as a generator for heat a large Bunsen burner, which consists of a hollow tube, at the bottom of which there is an inlet for coal gas, and at a certain height in the tube a number of openings through which the air rushes in to mingle with the gas; both air and gas issue at the top of the tube, and when ignited produce an intense heat. The flame so produced is made to play round a crucible containing the materials to be assayed, and which itself is surrounded by thick earthenware tiles, preventing the heat passing through the furnace from radiating itself in all directions, thus concentrating its action entirely on the little crucible placed in the centre. But the most perfect contrivance of the sort which has yet been brought to the notice of the public is one due to Mr. G. Gore, F.R.S. The following is the description of Mr. Gore's gas furnace:





—A is a cylinder of fire-clay, about 9 inches high and 6 inches diameter, open at both ends, and with a hole at the back part near the bottom, to lead into the chimney; it is covered by a moveable plate of fire-clay, B, with a hole in its centre for the introduction of the crucible or of substances to be melted; this hole is closed by a perforated plug of fire-clay, C, for access to the contents of the crucible; and that again is closed by another stopper of fire-clay, D. E is a chimney of sheet iron, about five or six feet high, kept upright by a ring of iron, F, attached to the top of the furnace. The fire-clay cylinder is enclosed in a sheet iron casing with a bottom of iron, to

which are fixed three iron legs, G. An iron tube, H, with a prolongation, I, supports by means of the screw, J, the burner, K, and its tube, L, which is open at both ends. Gas is supplied to the burner by means of the tap, M, which has a small index, N, attached to it for assistance in adjusting the gas. Inside the largest cylinder is another fire-clay cylinder or cupola, O, with open ends, and with three projections of fire-clay, P, for supporting the crucible Q; it is kept steady by means of three clay wedges; R S is an air-valve for closing the bottom of the tube L. The gas burner is a thin metal cylinder, deeply corrugated at its upper end, with the corrugations diminishing to nothing at its lower end, as shown in the engravings. The action of this furnace is as follows:—Gas is admitted to the open tube L by the tap M; it there mixes with air to form a nearly combustible mixture, which ascends through the burner, and burns in the clay cylinder O, being supplied with the remainder of air necessary to combustion through the tube H to the outer surface of the flame by means of the spaces between the corrugations. The flame and products of combustion pass up through cylinder O, and then downwards outside of it to the chimney, the point of greatest heat being at Q.

Mr. Gore states that one of his smallest furnaces, consuming 33 feet of coal gas per hour is capable of melting 8 oz. of copper and 6oz. of cast iron; that the next sized furnace, consuming about twice the quantity of gas, will melt 40oz. of copper.

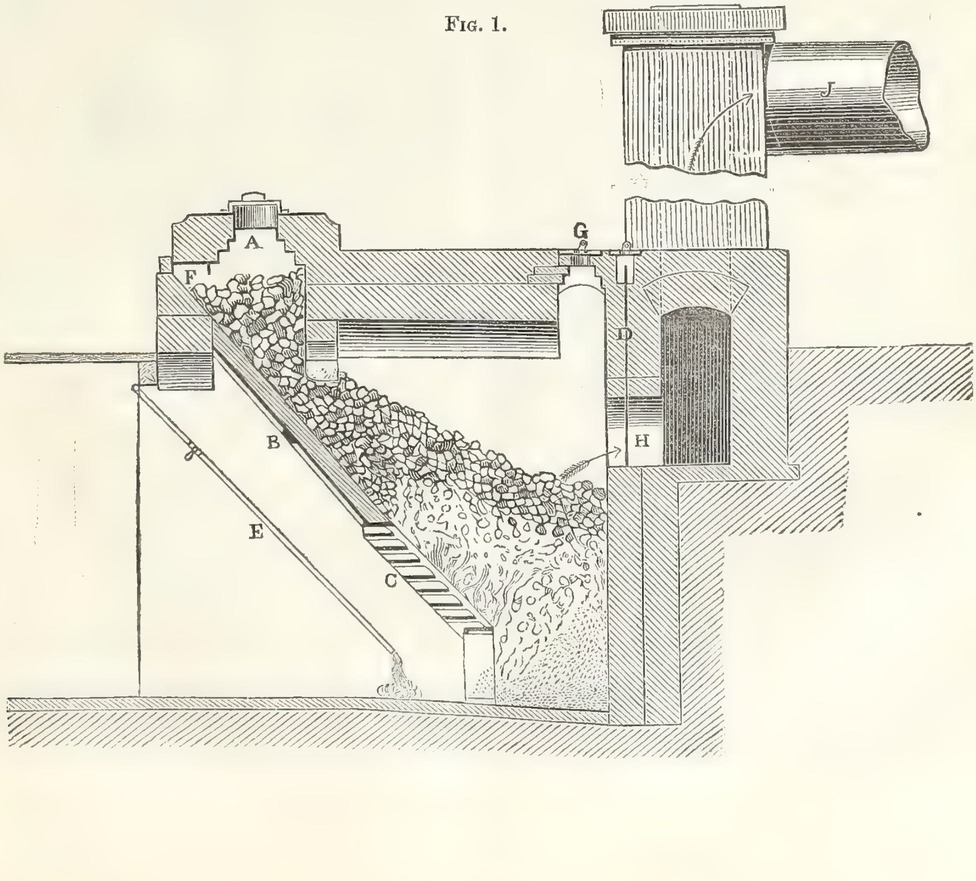
But the most important improvement which has been effected of late years in the production of intense heat by the combustion of the gases generated through the distillation of inferior coals, is that of Mr. C. W. Siemens, F.R.S., of Great George-street. The benefits which are conferred on manufacturers and the public by the furnaces devised by Mr. Siemens cannot be overrated. They are not only economical in their use, but as they enable the manufacturer to use an inferior class of fuel to generate the heat required, they must undeniably be of great advantage; and to the public in general they will be a great boon, as they do away with the nuisance attached to all manufacturing districts, in the dark black smoke escaping from chimneys, polluting the atmosphere and rendering it so disagreeable to those who are compelled by their occupations to live within reach of its influence.

I may state, *en passant*, that the large amount of black smoke which floats in the atmosphere of Manchester, Sheffield, Birmingham, and other towns, is not only injurious by depriving those places of much light so beneficial to life and health, but is also a nuisance from the immense amount of soot and dirt with which it is accompanied. There cannot be a doubt that, owing to the imperfect combustion which the products undergo in many of the furnaces belonging to manufacturers, and which is shown by the appearance of the smoke itself, the air is rendered more unwholesome than it would be if the products that escape had undergone perfect combustion, because volatile matters escape which are known to have a most destructive action on health and vegetation. The improved state of the public squares in London—and especially of those which are on the banks of the Thames—can be witnessed by all who have observed their condition since the consumption of smoke has been made compulsory in London and its suburbs.

Mr. Siemens's furnaces, I am happy to say, are not in a state of mere experiment, but they have received the sanction of a great number of manufacturers, and especially of those who little expected that the necessary heat for their operations could be obtained without interfering with their manufacture, in the carrying out of which they thought the production of smoke could not be prevented. Thus we find M. Siemens's furnaces employed with great success and economy in glass works, in potteries, and in iron forges, works which used to be a nuisance to their neighbours, by the large volumes of black smoke which they were constantly emitting from their chimneys.

Before describing Mr. Siemens's furnace, it is necessary

FIG. 1.



that I should state that, in the ordinary furnaces, only about 25 per cent. of the heating power of the fuel is rendered available in carrying out the manufacturing operations. This is due to imperfect combustion, and to the fact that only the heat of combustion exceeding that of the body treated is utilized; the remainder of the heat, in many instances, by far the greater proportion of the whole, being allowed to escape uselessly up the chimney.

I shall now give a description of one of M. Siemen's furnaces. The gas producer and furnace are quite distinct, and may be placed at any convenient distance from each other. The gas producer is shown in Fig. 1 (see page 713). The fuel is supplied at intervals of about two hours through the covered openings A, and descends gradually on the inclined plane B, which is set at an inclination to suit the kind of fuel used. The upper portion of the incline B is made solid, being formed of iron plates covered with firebrick, but the lower portion C is an open grate formed of horizontal flat steps. The opening under the lower step is made larger than the others, to enable clinkers to be withdrawn. The small stoppered holes F F at the front and G G at the top of the producer are provided to allow of putting in an iron bar occasionally to break up the mass of fuel and detach clinkers from the side walls. Each producer is capable of converting daily about two tons of fuel into a combustible gas, which passes off through the opening H into the main gas flue leading to the furnaces.

The action of the gas producer in working is as follows:—The fuel descending slowly on the incline plane B, becomes heated and parts with its volatile constituents, the hydro-carbon gases, water, ammonia, and a small proportion of carbonic acid, which are the same as would be evolved from it in a gas retort. There now remains from 60 to 70 per cent. of purely carbonaceous matter to be disposed of, which is accomplished by the current of air slowly entering through the grate C, producing regular combustion immediately upon the grate; but the carbonic acid (an incombustiblo gas) thus produced having to pass slowly through a layer of incandescent fuel from two to three feet thick, takes up another equivalent of carbon, and is thus transformed into carbonic oxide (an inflammable gas) which passes off with the other combustible gases to the furnaces. For every cubic foot of carbonic oxide thus produced, taking the atmosphere to consist of one-fifth part by volume of oxygen and four-fifths of nitrogen, two cubic feet of incombustible nitrogen pass also through the grate, tending greatly to diminish the richness or heating power of the gas. Not all the carbonaceous portion of the fuel is, however, volatilised on such disadvantageous terms; for water is brought to the foot of the grate by the pipe E, which, absorbing the spare heat from the fire, s converted into steam, and each cubic foot of steam in traversing the layer of from two to three feet of incandescent fuel is decomposed into a mixture consisting of one cubic foot of hydrogen, and nearly an equal volume of carbonic oxide, with a variable small proportion of carbonic acid. Thus one cubic foot of steam yields as much inflammable gas as five cubic feet of atmospheric air; but the one operation is dependent upon the other, inasmuch as the passage of air through the fire is attended with the generation of heat, whereas the production of the water gases, as well as the evolution of the hydrocarbons, is carried on at the expense of heat. The generation of steam from the water, being dependent on the amount of heat in the fire, regulates itself naturally to the requirements; and the total production of combustible gases varies with the admission of air, and since the admission of air into the grate depends in its turn upon the withdrawal of the gases evolved in the producer, the production of the combustible gases is entirely regulated by the demand for them.

The gas made in these producers has been frequently carefully analysed, and the average constituents of 100 parts have been found as follows:—

Carbonic acid	4·1
Oxygen	0·4
Carbonic oxide	23·7
Carburetted hydrogen	2·2
Hydrogen	8·0
Nitrogen	61·5
	99·9

The furnaces are applicable for all purposes where intense heat is required, such as for glass houses, puddling, heating iron and steel, iron melting for foundry purposes, steel melting, muffles and copper smelting. In all applications the furnaces are of the same construction in principle, the arrangements only varying with the different operations to be carried on in the heating chamber. The heating furnace has been selected for illustration in Fig. 2, page 715.

Underneath the heating chamber K, are placed transversly the four regenerators L L L L, which are chambers filled with fire bricks built up with spaces between them. The regenerators work in pairs, the two under the right-hand end of the furnace communicating with that end of the heating chamber, while the other two communicate with the opposite end.

The gas passes from the main gas flue through the reversing valve S into the flues R R, at the bottom of one of the regenerators L, up through which it passes to the port M. Air is also admitted through a reversing valve at the back of S (not shown in the figure), thence into the flues O O, up through the second regenerator L, to the port N, where it meets with the gas, mingles with it, and produces an intense and uniform flame, which distributes itself all over the heating chamber K.

The products of combustion together with the excess or waste heat of the furnace, instead of being passed, as in ordinary furnaces, up the stack, and either entirely thrown away or only partially utilized, are carried down into the other pair of regenerators, where they are deprived of their heat, and thence proceed through the reversing valves to the chimney by the flue T.

When one pair of regenerators has become considerably heated by the passage of the hot products of combustion for some time, and the opposite pair correspondingly cooled by the upward passage of the cold gas and air, the valves are reversed, and the currents of gas and air then pass upwards through the regenerators last heated, whereas the products of combustion pass through those opposite. The process of reversing is repeated at fixed intervals, generally every half hour, so that two of the regenerators are always being cooled by the gas and air taking up the deposited heat and carrying it back to the furnace, and two always being heated by the passage of the hot products of combustion passing down to the chimney, and depositing their heat on their way there.

The flame in the heating chamber is uniform throughout, and perfectly free from all extraneous matter. Its chemical nature is also perfectly under command by means of gas and air regulating valves (not shown in the engravings), so that the most delicate operations can be carried on with great uniformity.

The gas and air reach the heating chamber (after passing through the regenerators) at nearly the heat of that chamber itself, and in burning, in addition to the temperature due to their mutual chemical action, is added that they have taken up in passing through the regenerators, so that an intensity of heat is obtained, which, unless moderated on purpose, would fuze furnace and all exposed to its action.

The products of combustion are so completely deprived of the heat they brought out of the heating chamber K, by passing among the regenerator bricks, that the heat in the chimney-flue is seldom sufficient to singe wood; the economy is therefore due to the fact that little or no heat is thrown away up the chimney, as in the ordinary furnaces, and also to the perfect combustion of the fuel which is evidenced by the total absence of smoke from

the stack; whereas in the common furnaces the combustion is so imperfect, that clouds of powdered carbon, in the form of smoke, envelope all manufacturing towns, and gases are allowed to escape with two-thirds of their heating power undeveloped.

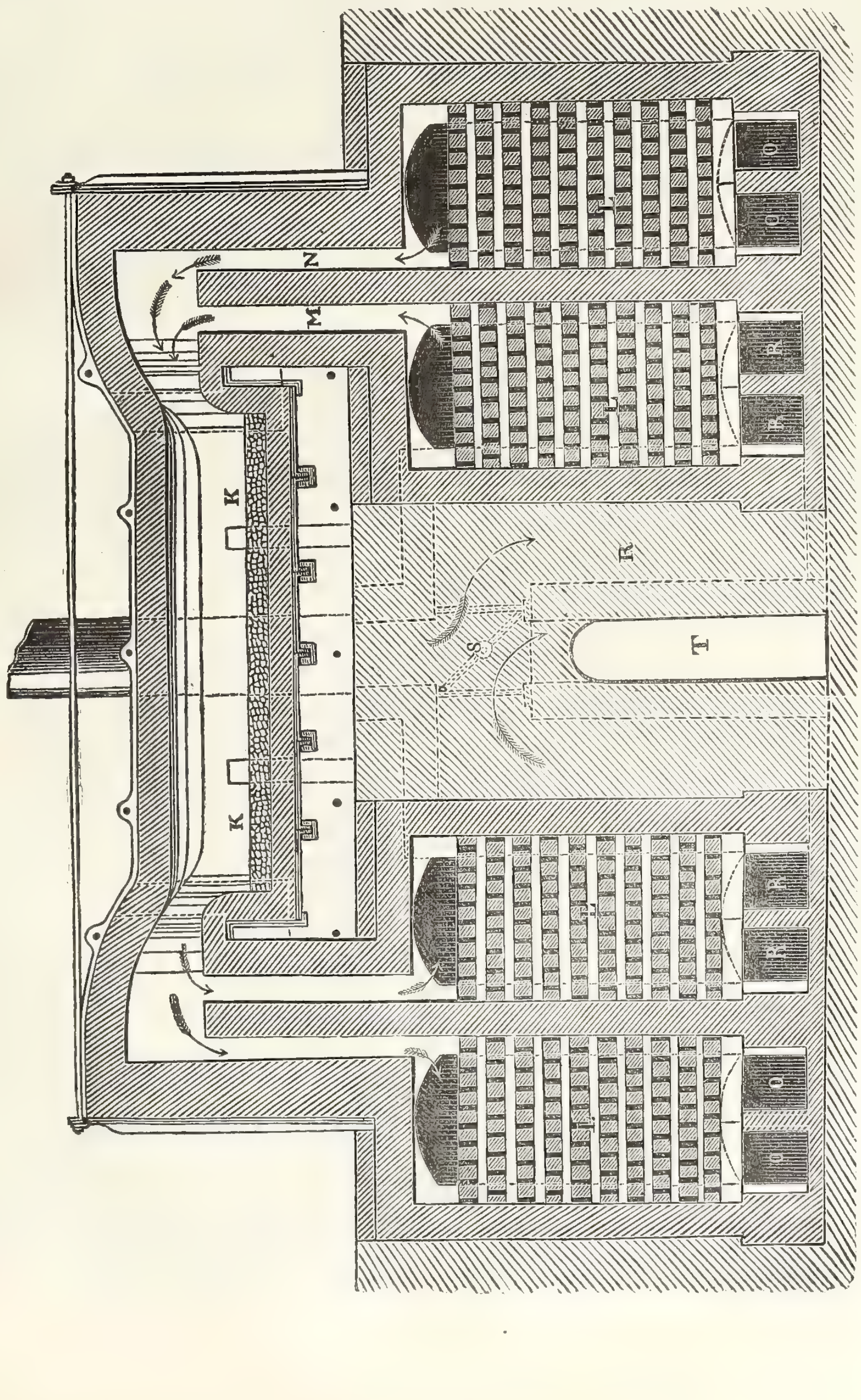
The saving of fuel in these furnaces, as compared to the ordinary kind, ranges between 40 and 60 per cent. in weight, according to the fuel used. In many instances an additional saving can be made in the cost of the fuel by using inferior qualities, such as coal and coke dust, lignite, and peat.

The intensity of the heat, purity of the flame, and the absence of cutting draughts in the heating chamber, is of great advantage for all metallurgical operations, tending greatly to improve the quality of the produce, and occasioning a saving of about 5 per cent. in the waste of the metal treated in puddling and iron re-heating furnaces, &c.

The peculiarities and advantages of these furnaces are, that gas fuel alone is employed, that perfect and entire combustion is obtained, and that the heat, which is usually allowed to escape up the chimney, is here stored up to be afterwards brought back to the furnaces.

Whilst on the question of the combustion of coals,

Fig. 2.



and of smoke, allow me to draw your attention to a clever invention by Mr. Snook, of Manchester, which he calls an "Invigorator." The invention may briefly be described as an apparatus placed within the semi-circle forming the upper portion of an ordinary register fire-grate, formed entirely of cast-iron, and so constructed as to be readily applied to all existing grates known as of the register form. In experiments which have been made, it has been proved that after lighting the fire (the whole of the apparatus being closed so as to act as a blower), a brisk bright fire is produced in about four minutes. A large concave elliptical plate immediately over the grate bars, suspended on end pivots, is tilted over to an angle of about 70 degrees, when it is seen that the back or concave portion of the plate, acts as a bright reflector, throwing out the heat rays into the room, instead of allowing them to pass up the chimney. Two horizontal plate doors, or louvres, above the reflector, are next opened, when the draught is found to be reduced to the smallest amount compatible with the continuance of combustion in the grate. The heat thrown out from the fire is considerable, and the fire itself forms a pleasant object to look at, having a warm red glow, without either flame or smoke proceeding from it.

The next invention I wish to call your attention to is one, which, like that of Mr. Siemen's, is calculated to render marked service to society. It is the production of motive power through the combustion of coal gas, and you will I hope appreciate the discovery due to Mr. Lenoir, if you will call back to memory the efforts which have been made for the last 20 or 30 years, to generate power by employing the expansion which air or other gases undergo under the influence of heat as a substitute for steam—the long promised success and the unfortunate failures of Ericsson. What especially recommends the engines of M. Lenoir is their safety, for there is no danger of explosion; their cleanliness, for they require no fuel; their simplicity, which enables those who employ them to use them in any room at any height and at any spot where motive power may be required, for they have only to erect a little engine of one or two horse power, and whenever they require to use it, all they have to do is simply to bring into contact two poles of a battery, when the fluid so generated will traverse space, and convey motive power to the gas engine. Lastly, these engines are extremely economical in their working, for they consume only 70 feet of gas per horse power per hour; and assuming that 1,000 feet of gas is worth 4s. 6d., the cost of working an engine of one-horse power will be about 4d. per hour. M. Lenoir's engine is very similar to the ordinary steam-engine, having a cylinder, piston, crank-shaft, and fly-wheel. The following proportions of gas are admitted in the cylinder:—One volume of coal gas mixed with twelve volumes of atmospheric air. This mixture is ignited by the electrical spark from a battery connected by wires at each end of the cylinder. The connection being made and broken by the rotatory action of the crank-shank, the expansive force necessary to move the piston of the engine is produced by the ignition of the gas, which not only produces steam and carbonic acid by their combustion, but by the heat generated increases their volume to a sufficient extent to force the piston to travel backwards and forwards, thus producing motion. The engine once fixed, the battery charged, and the gas turned on, it is ready for action, and as soon as the work required is completed, the gas is shut off, the engine stops, and the expense ceases.

The facility for employing Lenoir's engine in countries where coal is not easily attainable has been increased by substituting for coal gas a mixture of oxide of carbon and hydrogen, which can easily be procured on a commercial scale at a small cost by passing steam over heated charcoal, the water being decomposed, its hydrogen being liberated, and its oxygen combining with the carbon itself produces oxide of carbon, and the mixture of these gases is a cheap and good substitute for coal gas. Consequently M. Lenoir's engines can be employed with great advantage in our British colonies and in South America.

I shall now have the pleasure of calling your attention to an interesting and valuable invention of one of the most learned and eminent chemists of England, Dr. J. Stenhouse, F.R.S., who has devised quite a new method of waterproofing vegetable and animal tissues and fabrics. Previously to his discovery, the modes of waterproofing consisted in using bees' wax and various kinds of drying oils, such as linseed, the siccation of which is enhanced by boiling them with peroxides of lead or manganese. Further, you are all aware of the extensive use which has been made of caoutchouc and gutta percha for waterproofing purposes. Dr. Stenhouse's waterproofing material is a white solid substance, having no odour, undergoing no change through the action of the atmosphere, and which has acquired of late great popularity, by the application which has been made of it as an illuminating and lubricating agent,—I mean paraffin, the discovery of which, in a commercial point of view, and its introduction into public notice, are due to Mr. James Young, of Bathgate, near Glasgow, who has now established one of the largest manufactories in the world for the production of this article, notwithstanding it was considered a commercial novelty in 1852. Dr. Stenhouse found that if he employed pure paraffin for waterproofing, owing to its tendency to crystallise it would not adhere sufficiently to fabrics. He, therefore, conceived the happy idea of adding to it a few per cent. of linseed oil, which overcame the defects presented when paraffin was employed alone, effecting a better adhesion between the waterproofing material and the textile fabrics, and rendering leathers more flexible. Dr. Stenhouse melts together paraffin oil with a few per cent. of linseed as above stated. He runs the whole into cakes, and in order to apply this waterproofing agent he beats the cake and rubs the materials over with it or spreads the melted mixture over the fabric by means of a brush. His process is applied with great advantage by Messrs. Silver and Co., to the waterproofing of soldiers' tents, and other materials of that class, to the great comfort of the soldiers, for, without increasing the weight of their tents, it renders them impermeable, and protects the men from rain and its attendant discomfort and danger. Another most useful application of Dr. Stenhouse's waterproofing material is the rendering of leather impermeable; by examining the specimens you will immediately see the immense advantage that cavalry will derive from having their saddles rubbed over with this preparation, as it renders the leather incapable of absorbing moisture, and enables the soldier to mount his horse after heavy rain with as much comfort as if it had remained under shelter. It also renders the soles of shoes quite impermeable, and at the same time communicates to them great flexibility, so that the boots of navvies and other similar articles are rendered far more useful and durable, as we all know that the constant wetting and drying of leather expedites in a marked manner its decay. There is one more application of Dr. Stenhouse's waterproofing to which I should wish to call your special attention, as it is of interest to the manufacturers of Manchester and of Lancashire generally. In those districts large quantities of what is called waterproofing materials are used in packing the goods, and preserving them from external wet or injury. Many of these materials are made by covering a coarse calico fabric with a coating of boiled linseed oil, but this class of packing is very imperfect, and loses its strength rapidly, especially in hot climates, owing to the fact that the boiled oil absorbs oxygen and carries it on to the fibre, oxidising it, and thereby soon destroying its tenacity. By applying Dr. Stenhouse's process to the fabric previously to the drying oil, not only is great impermeability attained, but the fibre, being saturated with paraffin, is preserved from the subsequent oxidation which it would undergo under the influence of the atmosphere in the presence of the boiled oil alone.

I should have wished to have dwelt at some length on the interesting application which has been made of late years, especially on the Continent, of another coal product, which, like most of those whose origin is due to coal, has received many valuable and beautiful applications. The one I now refer to is called bisulphide of carbon, and is applied with great success not only to the extraction of fatty matters from various seeds and fruits, such as olive, linseed, &c., but in Algiers for extracting from flowers various essential oils, commonly called perfumes, such as essence of roses, lavender, jasmine, &c. You will, no doubt, remember also the useful application which bisulphide of carbon receives in the hands of Messrs. Allbright and Co., of Birmingham, in separating the common phosphorus from the red or amorphous phosphorus now applied to the manufacture of chemical matches, as explained to you in my first lecture of last year's course.

I cannot conclude what I have to say respecting coal products, without stating the fact that, since I had the honour of delivering a lecture in this room, in 1862, many beautiful and valuable discoveries have been made in connection with coal-tar colours. Dr. A. W. Hoffman has succeeded in obtaining some magnificent purples, by a process as curious as it is highly scientific, and such as might be expected from so talented a chemist. Since then a splendid green colour, called verdine, and which has the curious property of retaining that colour in artificial light, yea more than that—of increasing in beauty in the presence of that light—has been discovered by M. Eusebe. A beautiful fast black, easily applicable to the art of calico printing, has also been devised; and lastly, in the hands of Messrs. Simpson, Maule, and Nicholson, the well-known colour called magenta, and a beautiful blue called opal, have not only been much increased in beauty, but their cost of production has been materially reduced. In fact, at the present day, every shade of colour is produced from coal tar products; but the subject is too vast for me to attempt now to enter into details as to their mode of production and application.

As the hour is advancing, I must, though with regret, leave the interesting subjects which have reference to coal and its products, and pass to another class of manufacture. The first of these has reference to the refining of sugar, and among the several improvements which have been effected in this branch of manufacture during the last few years none is more important in its general bearing than that recently brought to the notice of the public by Mr. Alfred Fryer, of the well-known firm of Fryer, Benson, and Foster, of Manchester. This gentleman has published some valuable information on the composition of the sugar-cane juice, and the alterations it undergoes under the influence of heat and atmospheric air, and has conferred on the colonies a great boon by inventing an apparatus which will effect a great saving in obtaining sugars. Mr. Fryer's experiments on the cane juice teach us that, instead of only extracting 49 per cent. of the juice, as is usually the case, when the canes are worked by the old system, 61 per cent. can be obtained with a good steam engine having 24 inch rollers; and by pressing the megass a second time through the rollers as much as 70 per cent. can be obtained; and Mr. Fryer does not doubt that even 80 per cent. may be reached, if more attention is paid to the pressing of the canes through the rollers. Mr. Fryer has also published some interesting facts on the action of the oxygen of the atmosphere on cane juice. Thus he has observed that the juice rapidly darkens, and that this increase of colouration is not only an indication that the juice is undergoing deterioration, but that no amount of defecation will subsequently remove this colouration. He has further noticed that cane-juice rapidly becomes acid, and the acidity increases also in a very rapid manner. He gives an instance—a pattern of too many others—where the juice, after expression flowed down a spout 250 feet in length, from the mill to the boiling-house, occupying in its descent about half-a-minute. The amount of acidity increased from 100 to 253, and the colour deepened fourfold.

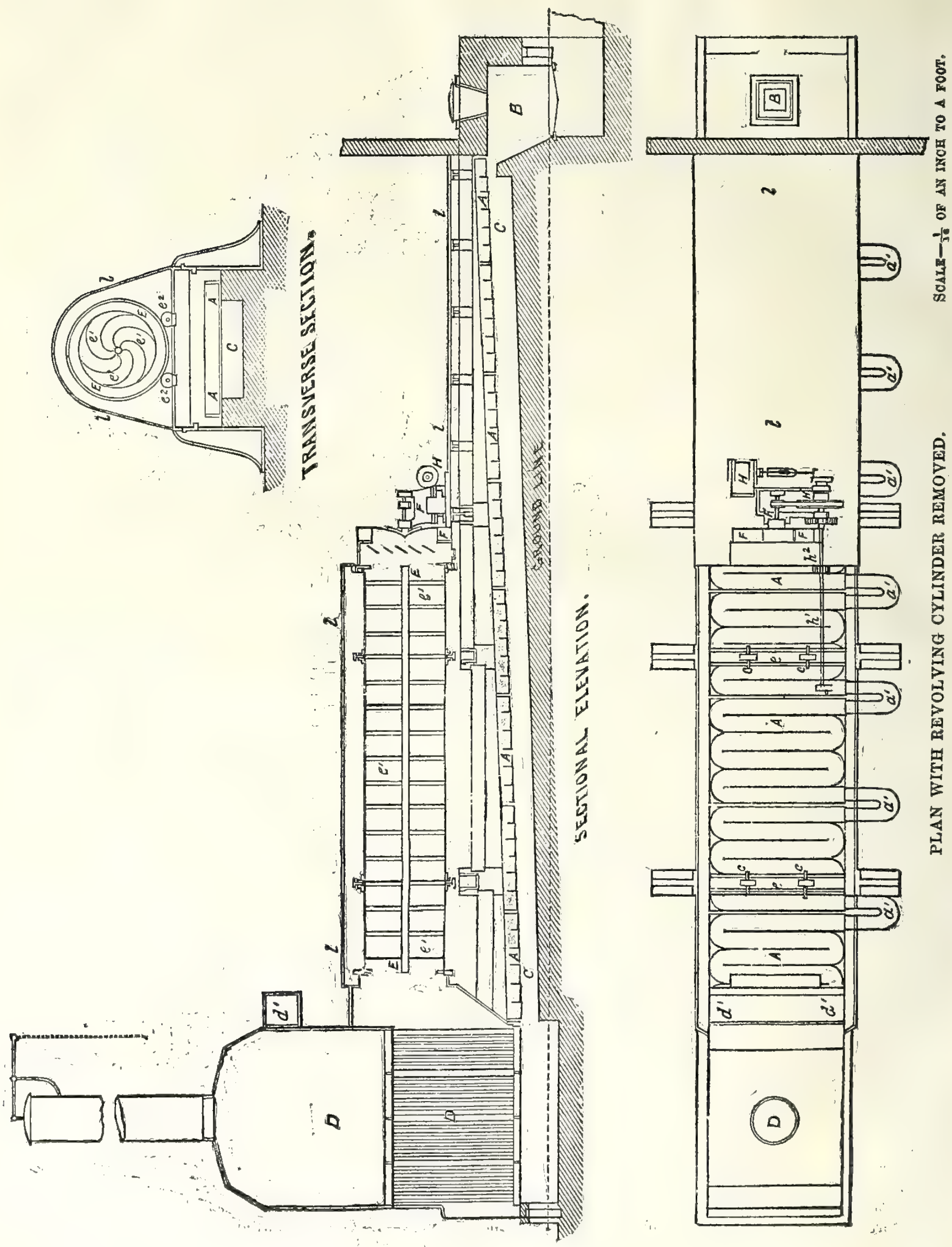
Mr. Fryer has also published some very interesting facts on the influence of heat on the cane sugar, and I here take the liberty of extracting from a paper of his the following facts:—

"We now come to the boiling. All heat above 140° is capable of exerting an injurious effect. As regards the time this effect is proportionate to the duration of the heat; the continuance of any syrup for two hours at any given temperature would cause just double the mischief which would be produced by its continuance at the same temperature for an hour. But as regards the heat, the mischief increases about as the square of the difference from 140° the highest innocuous temperature. So at 160° during any given time a certain degree of mischief would be done. To keep the same syrup for the same time at the heat of 180°, would give four times the mischief; at 200°, nine times; the difference of 180° from 140° being twice as great as that of 160°, and that of 200° being three times as great."

This mischief consists partly in the change of colour, partly in the change of a quantity of cane sugar or sucrose into fructose. Both these kinds of sugar are present in all neutral saccharine solutions. Sucrose is the ordinary crystallised cane sugar; fructose exists more especially in some kinds of fruit, such as grapes, gooseberries, cherries, oranges, &c., which refuse to form well-defined crystals. Further, I should remark that, under the influence of heat, as just stated, cane sugar or sucrose, is converted into grape sugar or fructose, and that the presence of fructose interferes in a most extraordinary manner by preventing the free crystallisation of sucrose. Thus, for example, every particle of fructose in a mixed solution detains from crystallisation its own weight of pure sugar. In fact, it would be impossible, after mixing equal weights of loaf sugar and fructose in a solution to recover the former in a crystalline state. The change produced by the atmosphere alone, without the action of heat, shows the necessity of proceeding instantly to raise the temperature to the boiling point, and the concentration should be continued without loss of time. The temperature should not, however, be raised beyond the lowest effectual heat.

I will now call your attention to Mr. Fryer's "concretor," as he terms the apparatus, which is delineated on page 718. It consists of A A, inclined corrugated plates, over which the juice flows; a^1 a^1, connecting gutters for joining plates; B, furnace; C C, flue under plates; D D, tube-box heated by waste heat of furnace; d^1 d^1, supply cistern for revolving cylinder; E E, revolving cylinder, through which the juice is passed after leaving the plates A A; e^1 e^1, curved blades revolving with cylinder, and exposing the liquor to the hot air; e^2 e^2, friction rollers for supporting cylinder; F F, fan for drawing a current of air through tube-box D D and cylinder A A; H H, engine for driving fan and cylinder; h^1 h^1, shaft for giving motion to cylinder E by means of pinion h^2; I I, covers for retaining around cylinder E the the steam given off from plates A A.

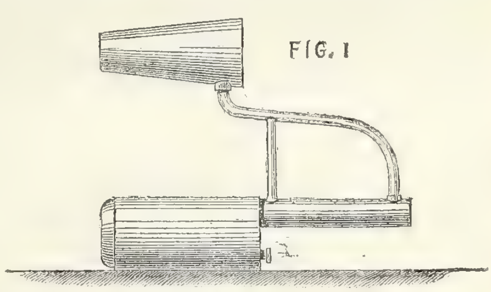
From the further end of the cylinder a pasty mass is discharged, and, in cooling, it hardens into a non-crystalline homogeneous substance likely to be long known as Fryer's "concrete." Its material is simply cane juice deprived of its vegetable albumen and water, and, not being contaminated by molasses or caramel, is admirably fitted for the operations of the refiner, and will, therefore, command his attention. Allow me, further, to add that his process is easy to conduct; the apparatus, as you see, is simple and self-acting, not liable to derangement; that it performs a large amount of work; and therefore proves a material saving to the sugar producer. I cannot conclude my remarks on Mr. Fryer's invention, as applicable to the colonies, better than by repeating here the words expressed by the Governor of Antigua, who said, "I believe firmly that you have opened a new era of prosperity to



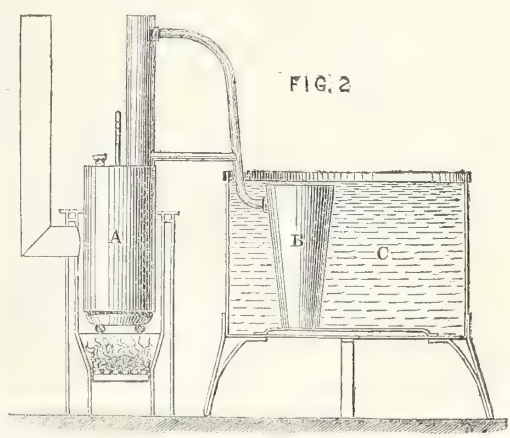
This illustration is one of the first applications of a new process for producing surface blocks from a drawing. It has been produced for this Society as an experiment. The drawing was placed in the hands of the artist on Wednesday morning, and the metal blocks ready for the printer were delivered the following day. It is right to state that, the drawing being of a geometric character in outline, the difficulty of production is greatly increased. It should be added, that the drawing having been placed in the hands of a wood engraver of eminence on Tuesday morning last, it was returned by him as impossible to execute wood blocks in time for this week's *Journal.* The process and its bearing on Art production will form the subject of a Paper to be read at an early meeting of the Society.—Ed. *S. of A. J.*

our colonies, and heartily wish you abundant success in the course on which you have entered." As to the advantages which a sugar refiner in this country will derive from employing Mr. Fryer's "concrete," instead of having to refine the molasses and coarse sugars usually imported into this country, they are so obvious that it would be really a loss of time to enlarge upon them. The saving to the refiner in having nearly pure sugar to operate upon, and not having to contend with the removal of colour, converted sugar, caramel, and other impurities, will at once convince you of the support and approbation the article will receive from the sugar refiner.

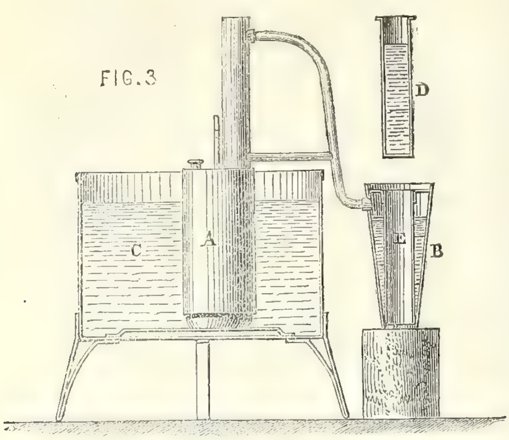
If, at the commencement of this lecture, I drew your attention to the value of intense heat produced at a small cost so as to enable our manufacturers to carry on their various processes, it now becomes my duty to inform you that of late years the cheap production and application of low temperatures has become a necessity, especially since organic products have been manufactured on an extensive scale. Three different machines for obtaining these low temperatures have been brought to public notice, viz.: First. That of Mr. Kirk, who has applied in a beautiful manner some of the physical laws discovered by Dr. J. P. Joule and Professor W. Thomson, in their researches on the mechanical theory of heat. Thus, Mr. Kirk succeeds in producing a low temperature by condensing under high pressure atmospheric air, which, on being allowed to resume its primitive volume, produces cold, for the compressed air cannot resume its primitive volume without the essential element for its expansion, namely, heat; and if the apparatus is properly contrived, which is the case in that of Mr. Kirk's, the heat necessary for the expansion of the compressed air is supplied to it by the body whose temperature is to be lowered. Although the construction of this machine is exceedingly costly, still it has been employed at Mr. James Young's works at Bathgate with great success to the cooling of paraffin oil to extract from it the solid paraffin which it contains. The second apparatus is that of Messrs. Harrison and Co., of London, who employ ether as the medium for producing low temperatures. The third is that of M. Carré—in my opinion the cheapest and most practicable apparatus yet invented for the purpose, the more so that it is applicable for household as well as for manufacturing purposes. Although I, like many of you, have witnessed the production of ice by it at the late exhibition, still I was not prepared to learn that it could be applied with economy to the extraction of some of the salts existing in sea-water. Still such is the fact. M. Ballard, a well-known French chemist, after many years' study and labour, succeeded in extracting from sea-water two products, which play a most important part in most of our large chemical works, viz., sulphate of soda and chloride of potassium. To produce the first, under ordinary circumstances, extensive works are required, such as are found at St. Helen's, and Newcastle-upon-Tyne, where thousands of tons of common salt are acted on by vitriol, which gives rise to muriatic acid and sulphate of soda. As to the salts of potash, the French, as well as ourselves, are dependent for it upon the forests of Russia and the native forest of Canada. By M. Ballard's discovery, France will free itself from a dependence upon foreign supplies for the potashes she may require, as well as the sulphur, and will also do away with the public nuisance, namely, the conversion of common salt into sulphate of soda. Without entering here into details, let me state that M. Ballard operates as follows:—In the early part of the spring season, considerable quantities of sea water from the Mediteranean are run into large shallow reservoirs. In the summer season the water evaporates, a certain proportion of common salt, separates, and the concentrated water is stored in other reservoirs until winter, when it is again allowed to flow back into the shallow reservoirs, where it yields, during a cold night, thousands of tons of sulphate of soda. The mother liquors from which the sulphate of soda has separated are allowed to flow into Carré's apparatus, where they are subjected to a comparatively intense cold, and yield large quantities of a double chloride of magnesium and potassium, which, on being subjected to heat in a furnace, gives hydro-chloric acid, magnesia, and chloride of potassium. This application of Carré's apparatus, in this instance, shows the simplicity and practicability of it. It is based on rather a different principle to those of Kirk and Harrison. To obtain a low temperature he applies heat to a vessel which contains a saturated solution of ammoniacal gas. This drives off the gas, which is made to pass into a vessel surrounded with cold water, where it liquifies itself by its own pressure. If then the heat be removed from under the solution, its temperature will gradually fall, and it will become again susceptible of re-absorbing the ammoniacal gas, thus facilitating its evaporation from the vessel in which it has condensed, and as it is necessary for the passage of the liquified ammoniacal gas into its gaseous form that it should absorb the heat from the surrounding medium, let it be water or any other fluids, their temperature will gradually decrease. The following diagrams will enable you to understand better the working of this invention :—



1. Before each operation incline the apparatus horizontally, and maintain it about ten minutes in the position represented in Fig. 1. 2. Place the boiler (A) in the furnace, and the refrigerator (B) in a bucket filled with cold water, so that the summit of the refrigerator be



covered with two or three inches of water. A small quantity of oil is poured into the tube which is placed in the upper part of the boiler, in which also a thermometer is placed. The apparatus is heated moderately until it reaches 266°. The apparatus is then removed from the fire, and the boiler is placed in the bucket of cold water. The hole of the refrigerator being stopped with a cork, and the tin vessel surrounded with alcohol, having previously nearly filled it with water, the congelation takes place by the evaporation of the liquid ammonia in the condenser.



Although the evening is far spent, I cannot leave you without calling your attention to a very ingenious mode, devised by M. Pelon, for warming railway carriages during cold weather. You are too well acquained with the present clumsy and expensive method now in use to require any description from me. The only remark I shall make upon it is that it is the boon of those who are in least need of it, namely, first-class passengers, whilst those of the second and third classes have not that luxury supplied to them. To avoid loss of time, I shall not attempt to describe the various methods which have been proposed as substitutes for the one at present in use, but shall at once state that M. Pelon's method is based on the conversion of force into heat, the heat in this case being generated by friction; and from what I stated in my first lecture you must be perfectly *au courant* of what is understood in the present day of the conversion of heat into force, and *vice versa.* All those persons who were fortunate enough to visit the French Exhibition in 1855 must have been struck with a machine, invented by Messrs. Mayer and Beaumont, which generated enough heat to convert water into steam and thus obtain a motive power; and this was effected without fuel or electricity, but by mere frictional heat, which they obtained by causing a wooden mandril surrounded with tow to revolve with great rapidity inside a copper cylinder which itself was surrounded with a small quantity of water. The great merit of the invention of these gentlemen, and which drew upon them the special attention of the Emperor, was that neither the towed mandril, nor the copper cylinder were materially injured or deteriorated after many days' working. This important end was attained by them by allowing a gentle flow of oil to run constantly through the cylinder, thus preventing immediate contact between the towed mandril and the copper cylinder. In fact, the frictional heat was produced through the friction which took place between the particles of oil themselves, preventing thereby all wear and tear. Notwithstanding the ingenuity displayed in this invention, still as a means of obtaining motive power it was useless, for more force was required to generate an amount of heat than could be yielded by the friction of the particles of oil. But in the application which M. Pelon has made of this invention to the heating of railway carriages, the motive power required to generate the heat being produced without cost to railway companies, as it is caused by the very act of the travelling of the carriages themselves, the cause which accounted for the failure of the principle as a practical mechanical application, namely, the production of the force required to work it, is overcome. M. Pelon proposes to fix one of Messrs. Mayer and Beaumont's mandrils under each railway carriage compartment, and to convey the heat produced by the revolution of the towed mandril to the compartment itself by means of metallic conducting surfaces, which in their turn will heat the atmosphere of the compartment. We shall, I am happy to say, within a year or two, know if M. Pelon's invention will be capable of general adaptation, as it is now being practically tested on one or two of the French railways.

Proceedings of Institutions.

Kent Association of Institutes.—The first annual meeting of the council was held at Ashford, on the 6th of July last, when H. Whitfeld, Esq., of Ashford, presided. It appears from the report that, immediately after the formation of the society, in July, 1864, the committee forwarded to every known Institute in the county, a prospectus, setting forth the objects and rules of the Association. They also issued a series of questions, with a view to the preparation of a table descriptive of the nature, position, and operations of Kentish Institutes. The replies placed the committee in possession of the following useful information:—That the Institutes in Kent number about seventy: of these twenty-five are termed Literary, or Literary and Scientific; ten, Mechanics' Institutes; seven, Mutual Improvement Societies; two, Soldiers' Institutes; six, Working Men's Clubs; ten, Young Men's Societies; six, Reading Societies; and four bear the less definite name of Institute. Most of these societies possess libraries, which contain in the aggregate about thirty-two thousand volumes, and are circulated amongst nine thousand members. Lectures are annually delivered at about fifty of the Institutes. Penny readings appear to have been successful at upwards of twenty. In-door amusements, such as chess and draughts, are provided by twenty; and out-door sports, as cricket, by seven. About thirty-five of the Institutes possess reading-rooms. In twelve classes have been formed for instruction in one or more of the following subjects:—Reading, arithmetic, writing, French, drawing, Latin, and music. Only six appear to have given attention to the schemes of examinations connected with the Society of Arts and other Educational Societies. The apparent wants of many of the Institutes may be classified thus:—1. Means of obtaining, at small cost, the services of suitable lecturers. 2. An acquaintance, on the part of the members, with the advantages derivable from the Society of Arts and other examinations. 3. Teachers qualified to conduct evening classes. 4. The formation or extension of libraries. 5. The possession of commodious premises. 6. That measure of public support which should be received specially from those classes for whose benefit the Institutes exists. To aid in supplying these wants (says the report) is the chief duty of this Association, and the committee have to point out how far they have been able to promote so important an object. A list of gentlemen willing to give lectures or readings to Institutes (on payment of travelling expenses) has been prepared and published. It contains at present only twelve names, but it will, in all probability, be considerably extended before the next winter season. The Society of Arts Elementary Examinations, also the Oxford Local Examinations, have been brought prominently before the notice of the inhabitants of Kent; and the Committee rejoice that their efforts in this direction have been crowned with no small measure of success. Through the liberality of gentlemen taking a great interest in the work of adult education, the committee are in a position to offer prizes, in books, to successful candidates at the examinations. Arrangements have been made for the establishment of a circulating library. For an annual subscription of two guineas, schools and Institutes will be entitled to fifty volumes at one time, which may be exchanged at the expiration of three months. Numerous applications have been made to the secretary for information as to the most suitable description of building for Institute purposes, and also as to the usual modes of raising funds for the erection of

public buildings; and it is gratifying to know that some of the Associated Institutes are now in possession of very commodious premises, whilst others are making efforts to obtain adequate accommodation. The following schools and Institutes have been admitted into Union:—Ashford Mechanics' Institute, Chatham Mechanics' Institute, Chilham Mutual Improvement Society, Faversham Institute, Hamstreet Mutual Improvement Society, Rhode-street Schools (Chatham), Lenham Mutual Improvement Society, Sheerness Literary Institute, Ramsgate Working Men's Club, Whitstable Institute, Sittingbourne Institute, Staplehurst Mutual Improvement Society, Tunbridge Mechanics' Institute, Deptford Grammar and Collegiate School, Deal and Walmer Institute, Belgrave Mechanics' Institute (Tunbridge Wells), Ashford Mutual Improvement Society, and Lenham Grammar School. Returns made by eleven of the Institutes give as the total number of their members, 2,757; and of volumes in the libraries, 11,852. The Treasurer's statement gives the total receipts as £77 5s. 6d., and the expenditure as £50 18s. 6d., leaving a balance in favour of the Association of £26 7s.

CONSERVATOIRE IMPERIAL DE MUSIQUE ET DE DECLAMATION OF PARIS.

The following memoranda, having reference to the present state of the Conservatoire at Paris, and to the recent examinations held there, have been furnished by an occasional correspondent of the *Journal*:—

Officers of the Conservatoire.

Director—M. Auber, Member of the Institute of France; Secretary—M. Alfred de Beauchesne; Librarian—M. Hector Berlioz, M. of the Institute; Administrator—M. Lassabathie; Director of School—M. Duvernoy.

Professors, Assistants, and Teachers.

	Professors (Male).	Professors (Female).	Sub-Professors and Assistants (Male).	Sub-Professors and Assistants (Females).
Composition, counterpoint, and fugue	4	...	...	...
Written harmony	2	...	...	...
Thorough bass and practical accompaniment united	2	...	...	1
Vocal music	8	...	...	..
Sol-fa	4	...	4	6
,, collective	2	...	...	...
Vocal pieces	1	...	...	...
Lyric declamation	3	...	...	...
Theatrical comportment	1	...	...	...
Fencing	1	...	...	...
The study of parts	1	...	...	...
Reading aloud	1	...	...	...
Popular singing for adults	1	...	...	...
Dramatic declamation	3	...	1	...
Organ and improvisation	1	...	...	...
Piano	4	...	2	...
Instrumental pieces	4	...	...	...
Scales, "Clavier"	...	2	...	3
Harp	1	...	...	...
Violin	4	...	...	...
Violincello	2	...	...	...
Bass viol	1	...	...	...
Flute	1	...	...	...
Hautbois	1	...	...	...
Clarinet	1	...	...	...
Bassoon	1	..	...	...
Horn	1	...	...	...
Cornet-à-piston	1	...	...	...
Trumpet	1	...	...	...
Trombone	1	...	...	...
Military Class:—		...	...	...
Thorough bass and composition	2	...	...	...
Cornet	1	...	...	...
Saxophone	1	...	...	...
Saxhorn	1	...	...	...
Sol-fa	2	...	...	...
Total	66	2	7	10

In the list of professors are—M. O. Carafa, member of Institute; M. A. Thomas, ditto; M. Reber, ditto; M. Clapisson, ditto; M. Benoist, M. Henri Herz, M. Sax, M. A. Elwart, M. F. Bazin, M. Révial, M. Battaile, M. Giuliani, M. Masset, M. Fontana, M. Tariot, M. Duvernoy, M. Batiste, M. Pasdeloup, M. Levasseur, M. Morin, M. Mocker, M. Samson, M. Beauvallet, M. Regnier, Mdlle. Augustine Brohan, M. Georges Mathias, M. Prumier, M. Alard, M. Massard, M. Franchomme, M. Labro, M. Dorus, M. Cokken, M. Gallay, M. Meifred, and M. Arban.

Pupils.

The number of pupils is on the average six hundred, and there is no charge whatever for the general instruction of the Conservatoire in any of its classes. All are out-of-door pupils with the exception of twelve young men in the vocal school who are lodged, clothed (in uniform), and supported within the establishment. There is a box at each of the operas reserved for these young men. There were formerly as many female pupils lodged in the Conservatoire, but this was found so troublesome that pensions have been substituted in the place of residence. By way of compensation, a certain number of female pupils receive a pension of 800 francs a year for two years. All the in-door pupils and pensionaires are bound to appear, if required, at one or other of the operas or theatres receiving a subvention from the government; and no pupil in the schools is permitted to appear in public without the special authority of the direction.

Form of Application.

Each applicant for admission must apply personally, and produce certificates of birth and vaccination, must be French, and not less than nine nor more than twenty-two years of age. The applicants are examined by a professor, and if, according to his judgment, they are sufficiently advanced to complete their education in two years, or exhibit peculiar aptitude, they are admitted provisionally, and are again examined at the general meetings for that purpose, which occur in May and December. There is also an extra examination for the admission to the singing class in March. No set form of application.

Foreigners.

Foreigners may be admitted by authorization of the minister of state.

Provincial Schools.

There are five provincial schools—at Lille, Toulouse, Marseilles, Metz, and Nantes, which have the title of *succursales* of the Conservatoire, the last having been thus nominated in 1846. Some years since pupils were examined in these schools and sent up to the Paris Conservatoire, but this has been discontinued for some time, and candidates from the provinces have now to present themselves personally to the directors of the Conservatoire for admission. For all purposes connected with the pupils these local schools seem now to be completely dissevered from the Conservatoire—why, does not appear. That of Toulouse, however, exerts a very powerful influence, and supplies a large proportion of

successful pupils. Not only is there no preliminary examination in the provinces, but there is no recommendation of pupils by any of the authorities or musical professors in the provinces.

Classes.

The education is divided into the following eight sections:—1. Solfa, scales and oral harmony. 2. Singing. 3. Lyrical declamation. 4. Piano and harp. 5. Stringed instruments. 6. Wind instruments. 7. Thorough bass, organ, and composition. 8. Dramatic declamation.

There are also courses of popular singing for adults, superior to those in the common schools.

The actual *classes* are, or were not long since:—

2 for Solfa, number of pupils unlimited.
12 for do. for individual practice, twelve pupils in each, limited to two years' duration.
1 for Oral harmony.
5 for Scales, 2 male, 3 female, limited to 8 pupils each.
8 for Singing, limited to 8 pupils each.
1 for do. *en masse.*
4 for Lyrical declamation.
5 for Piano, limited to 8 pupils each.
3 for Violin; 2 for Violoncello; and
1 for each of the other instruments.
1 for the performance of instrumental pieces.
6 for Harmony and accompaniment, 4 male, 2 female, limited to 12 each.
1 for Organ and Improvisation, 12.
4 for Composition, subdivided into counterpoint, fugue, and ideal composition.
3 for Dramatic declamation.
1 for Deportment }
1 for Dancing } For theatrical pupils.
1 for Fencing }

Library.

There is a fine library of music, and of works relating to music and the drama, and this is open not only to the pupils but also to the public.

Museum of Instruments.

There is a good collection of musical instruments attached to the Conservatoire, to which the public is admitted on certain days of the week.

Rooms.

The Conservatoire is a very large establishment, and includes a complete theatre, a smaller theatre or concert room, and innumerable class rooms of all sizes besides the library, offices, and apartments for the in-door pupils.

Competitions.

The annual competitions now take place in July, instead of August. They commenced this year (1865) on the tenth and ended on the twenty-ninth of the month, occupying twelve days in all. With the exception of the classes for the organ, harmony and accompaniment, fugue, thorough bass, scales and solfa, the competitions are conducted in public. They take place in the theatre of the Conservatoire, erected in 1806, and in which are given the famous concerts of the society formed within the Conservatoire, but not being officially a portion of it. This theatre holds more than 900 persons, but in a most inconvenient manner, but the excellence of the building for sound has hitherto set aside all idea of its reconstruction. It is arranged like an ordinary theatre, with three principal tiers of boxes, a balcony in front of the lower tier, *baignoires* around the pit, a gallery divided into boxes and stalls, a pit and pit stalls. The pit holds 150 persons, and there are 180 stalls. The form of the building is oblong, with circular ends, the stage and orchestra occupying more than half the whole area. The wall at the back of the stage is not in fact semi-circular but ten-sided. In the centre of the principal tier of boxes is the *loge-d'honneur*, which is the Imperial box for the concerts of the society, and for which the Emperor makes a donation of two thousand francs a year, and behind this is a good-sized antechamber.

Prizes.

During the competitions this box with the antechamber are devoted to the jury, who, after listening to the performances of the pupils in one section or class, retire and decide on the awards before another class commences; each pupil to whom any award is made is then called forward, and the decision of the jury announced to him. If the award has been unanimous that fact is announced also. The prizemen in the instrumental classes, with the exception of the great instruments, receive an instrument as their prize, others receive books of music, and the pupils of the elementary classes medals. Each successful pupil receives a written diploma in addition.

Jury.

The Jury generally consists of nine members, chosen according to the nature of the competition of the day—whether vocal, instrumental, or dramatic—from a body of thirty.

There are, however, five members who are present on almost all occasions, viz.:—M. Auber, Director; M. E. Monnais, Imperial Commissioner for the Lyric Theatres; M. Kastner, member of the Institute, composer; M. J. Cohen, composer; and General Mellinet, an eminent amateur and composer.

In addition to these gentlemen the following acted as members of the Jury during the competitions just concluded:—

M. Cabenis, Chef de Bureau of the Minister of Fine Arts (official); M. De Leuven, Director of the Opera Comique; M. Perrin, Director of the Grand Opera; and M. Hainl, Conductor of the Grand Opera—(Ex-officio members). MM. Ambrose Thomas (member of the Institute), F. Bazin, Benoist, Dauvernoy, E. Jonas, Clapisson (member of the Institute), Prumier, V. Masset, Pasdeloup, Elwart, and Cokken—Professors in the Conservatoire. MM. Wakerlin, composer; Rinaud de Vilbac, composer and pianist; Ravina, pianist; Wieniawski, pianist; Cuvillon, violinist; Léon Réquier (member of the Institute), Professor in the College of France; Colin, harpist; and Cremieux, composer.

As already stated, all the competitions are open to the public, with the exception of those amongst the pupils of the elementary classes; but in the case of opera, comic opera, and still more of tragedy and comedy, the demand for places is so great that the theatre is not half large enough to hold those who apply for seats and obtain them, as far as they go, by favour of the director. In the case of the vocal and instrumental competitions, the theatre is not half filled, and the military music attracts only the friends of the pupils themselves.

Competition of 1865.

Private (four days), prizes awarded:—

Fugue—2 first and 1 second, males.

Harmony and Accompaniment—1 first prize, divided between two young men; two first prizes to females.

Harmony alone—1 first prize between two males.

Scales—36 competitors, male and female; 7 third prizes to female pupils.

Sol-fa — 125 competitors; prizes, 8 first medals, 9 second medals, and 8 third medals to male pupils; 11 first medals (one gained by a child nine years old), 14 second medals, and 6 third medals to female pupils.

Public:—

Singing—(male classes) 20 competitors and 11 awards, viz., 1 first and 3 second prizes; "accessits," or honourable mentions, 3 first, 2 second, and 2 third; (female classes) 30 competitors and 17 awards, viz., 4 first and 3 second prizes; and 2 first accessits, 3 second, and 3 third.

Pieces—air, 2nd act "La Dame Blanche;" air, 4th act "Lucie;" air, "La Juive Moïse;" rondo, "Cenerentola;" air, "Macbeth;" air, "Traviata;" air, "Norma;" air (Joseph), "Vaniceunt Pharaon;" air, (Mousquetaires) "Bocage épais;" air, "Fille du Regiment;" and air, "Pré aux Clercs."

Violin—Piece selected, 8th Concerto of Rode, 23 competitors, male and female. Prizes, 3 first (1 female) and 1 second; 1 first, 1 second, and 1 third accessit.

Violoncello—8th Concerto de Romberg; 1 first prize, 2 second prize, and 1 accessit.

Opera Comique—This is the most popular portion of the competition, and also that in which the pupils are generally strongest. It was especially so this year. There were 22 competitors, male and female, and 17 awards, viz., male pupils, 1 first, 2 second prizes, 2 first, 3 second accessits; female pupils, 3 first prizes, 2 second prizes, and 2 first and 2 second accessits.

Acts and Scenes, performed as well as sung, in stage costume:—Scene from "Le Tableau Parlant;" fragment of 1st act of "La Fiancée;" scene from "Les Dragons de Villars; fragment from "Les Dragons de Villars;" finale of "Noces de Jeannette;" scene from "Noces de Jeannette;" scene, 3rd act, "Mousquetaires;" finale, 1st act, "Galathée;" operetta, "Le Chalet;" operetta, "Le Maître de Chapelle;" scene, "Barbier;" scene, 1st act, "Songe d'un Nuit d'Eté;" and scene, "Toréador."

Piano—11 male and 35 female competitors. (This class is generally pronounced to have been weak.) Male pupils, 1 first, 2 second prizes; 2 first, 1 second, 2 third accessits. Female pupils, 3 first, 3 second prizes; 3 first, 3 second, 4 third accessits. Piece played by male pupils, "Concert Stück" (Weber); pieces played by female pupils, "Concerto in B minor" (Hummel).

Harp—4 competitor. 1 first accessit only awarded.

Opera—18 Competitors; awards, male pupils, 1 first prize (divided between 2 pupils), 2 second prizes; 3 first 2 second accessits; female pupils, 1 first prize (divided between 2 pupils), 1 second prize, 1 first, 1 second accessit. Acts and scenes given:—Last scene "Romeo et Juliette;" scene, "Robert le Diable."

Wind Instruments—Flute, 1 first, 1 second prize; 2 first, 1 second, 1 third accessit. Horn, 1 second prize; 1 first accessit. Clarionet, 1 first, 2 second prizes; 1 first, 1 second accessit. Bassoon, 1 first, 1 second prize. Hautbois, 1 first, 2 second prizes; 2 first, 2 second, 1 third accessit. Sarcophone, 1 first prize, 1 first prize divided in 2, 1 second prize, 1 second prize divided in 2; 3 first, 3 second, 3 third accessits. Saxhorn, 2 first, 1 second prize; 3 first accessits. Trumpet, 2 second prizes; 2 first, 1 second, 1 third accessit. Trombone, with slides, 1 first prize. Trombone-à-piston, 1 first prize; 1 first accessit. Cornet-à-piston, 2 first, 3 second prizes; 1 first accessit. The instrumental classes bear a high reputatien.

Total Awards.

The total of the above awards is:—

	1st Prizes.	2nd Prizes.	3rd Prizes.	Accessits.
Harmony, &c....	6	1	0	0
Vocal music	11	13	0	31
Instrumental	19	24	7	50
Total.........	36	38	7	81

in addition to the medals given to the pupils in Sol-fa, 56 in number.

Two of the prize-holders were immediately engaged by the director of the opera, and are announced to appear in "Marie."

Distribution of Prizes.

The public distribution of the prizes took place on the 4th of August, under the presidency of Marshal Vaillant, the Minister of the Beaux Arts, supported by the First Chamberlain of the Emperor and Superintendent of the Theatres, Count Baciocchi; M. Camille Doucet, Director of the Theatres; M. Auber and all the principal professors; and the managers of the Imperial theatres.

The principal point in the President's Speech was that which referred to the fact of an augmentation in the grant to the Conservatoire having been made during the last session of the Corps Legislatif, to the extent of £836, with the view of increasing the salaries of the professors.

The meeting concluded with the performance, by the pupils, of—A fantasia on the violin; an air from "Macbeth;" an air from "La Dame Blanche;" selections from "Le Barbier de Seville;" and selections from "Roméo et Juliette."

MISCELLANEOUS.

Common Schools.

A competition took place a short time since between the schools (communal) of the left bank of the City of Paris, in Harmony, Reading at Sight, Sol-fa, and Dictation. The Jury included—M. Victor Foncher, President of the Imperial Commission for Singing; M. Ambrose Thomas, General Mellinet, Edouard Rodrigues, Bazin, and others. There were distributed to certain schools — For adults, 3 first prizes and 2 second prizes. For boys, 3 first prizes and 1 second prize (divided). For girls, 1 first prize and 1 second prize.

Schools for Religious Music.

The competition amongst the pupils of the School for Religious Music took place on the 28th of July, under the presidency of M. Victor Hamille, Director of the Administration des Cultes, and M. Lefèvre Niedermeyer, the Director of the school. The following is the list of awards:—

Musical composition, counterpoint and fugue, harmony, organ (two divisions), *plain chant*, piano (two divisions) —2 prizes in each, first and second class; sol-fa—1 prize.

It is remarkable that of all the laureates only one was of Paris, the others were from Pamiers, Arras, Dijon, Montpellier and Cambrai.

International Competition at Cambrai.

The international competition took place at Cambrai, on the 20th of August last. Four thousand artists sent in their names for the competition. MM. Ambrose Thomas, Gounod, Bazin, Elwart, Gevaert, Laurent de Rille, Sernaet, and other well known composers and professors, formed part of the Jury. The prizes were twelve "medals," of 300 francs each.

Payment of the Opera Band.

The members of the orchestra of the Grand Opera have lately petitioned for an increase of salary, which has not been accorded. It appears that ten only of the performers receive 2,500 francs (£100) each a year; eight, from 2,000 francs to 2,200 francs each; twenty-nine, from 1,300 francs to 1,800 francs each; thirty-four, 1,200 francs each; one, 1,100 francs; one, 950 francs; and one, 750 francs. The petitioners asked for a slight rise in the higher salaries, and that each artist playing instruments, in the case of which a competitive examination is enforced, shall have at least 1,800 francs per annum. Amongst the solo players at the opera at the present moment are:—Flute, M. Dorus; Horn, M. Mohr; Cornet-à-piston, M. Forestier; Trombone, M. Dieppo (Professors at the Conservatoire); and MM. Altès, Cras, Berthélemy, Leroy, Rose, Maury, Lendet, and Garcia. The whole of these gentlemen are members of the Society of Concerts in the Conservatoire, and of the Imperial Chapel band.

The performances at the Opera occur three times a week besides Sundays.

Commerce.

THE SUGAR TRADE.—The news of the French beetroot crop (say Messrs. Travers) continues to be favourable. The weather is beautiful, and, from the drought, little else can be done in the fields, so that the roots are being rapidly taken up and sent to the factories. Growers wish to profit by the unusually good condition of the root, and the facilities for transport given by the long days and fine weather. "Caution should be used, however," says the *Journal des Fabricants de Sucre*, "by the makers in taking

in supplies, for it is doubtful whether the root will keep long in weather like the present—a burning sun, and nights not yet cooled by the autumn frosts. As to the result of the manufacture, it is as yet too early to give an opinion, but, notwithstanding some complaints of a want of density in the juice, there is ground for believing that a better yield than last year's will be obtained. The season 1865-6 thus commences under favourable circumstances, and bids fair to be highly remunerative to the growers, the makers, and to France at large. The news from Germany is also improving. The misfortunes of the summer have been to a considerable extent impaired by the late superb weather, and even the field injured by the grey worm look far better than could have been expected some time since. An average harvest of the root is looked for in Germany. The reports as to the saccharine richness of the juice differ greatly, but there is as yet little authentic information to be had, as most of the makers have put off commencing work for some weeks later than usual, in order to let the root benefit as much as possible by the favourable weather. In Silesia, however, it is ascertained that the juice is very rich and easy to work. Fourteen and even 14·5 per cent. of sugar is shown by the polariscope to exist in the juice, in by no means rare cases." While the prospect of the crop is thus generally favourable, its abundance has created alarm in the French market, where a perfect glut of sugar appears to be anticipated. The rise in the price of cane sugar in England, while in France the advance has been to nothing like the same extent, has called the attention of English buyers to the French market; and large purchases have been made of cane and beetroot sugar for our ports. This new outlet has given more confidence to the French makers, and has enabled many of them to make remunerative contracts. The purchases of refining kinds of beetroot sugar for Great Britain have been large, but we believe that the orders have principally come from the Clyde. We hope, however, at a not distant date, to see crystallised beetroot sugar, suited for direct consumption, regularly offered in this market. Pieces have already been sold for forward delivery in this market. White crystallised sugar is now quoted at 35fr. the 50 kilos. in Paris, or about 43s. 6d. here; and even if there is not sufficient margin between prices in the two countries at present, we shall probably before long see fine French sugar, defying the higher duty and competing with our refiners' goods in moist as well as stoved kinds. It is certainly a remarkable fact that the foreign refiners, in spite of the charge for freight, the 12s. 10d. duty, and the equitable drawbacks supposed to be established by the Convention, should be enabled to beat our refiners in their own markets. We Englishmen, in our national pride, are too apt to pre-suppose that we can beat all foreigners in machinery and its applications to our own particular province. But this over-confidence in our own merit has lately had some severe shocks, in the inability of English to compete with foreign machinists in supplying locomotive engines and other machines. Presumptuous persons have even ventured to hint that we are far inferior to the French, and even to the Scotch, in everything connected with sugar-making; but the chilling reception given to their insinuations has discouraged a repetition of the attempt to shake the confidence of Londoners in the skill of their countrymen. The foreigners certainly use a far better class of sugar for refining, and it would be worth while to find out why they do so. Is it because the continental consumption of brown sugar is limited, and that in consequence of this fact the refiners buy a strong and fine sugar in order to leave as little pieces as possible? If this explanation be correct, it is evident that the reason of the foreigners making cheaper sugar is found; for in order to enable the pieces and bastards left after extracting the loaves to compete with raw sugar, the London refiners have been obliged to sell the lower products at little or no profit, and to get their profit from the stoved sugar. The English public use brown sugar in very large quantities, and there is thus some apparent justification for the practice of buying comparatively low qualities at a cheap rate, with the view of supplying the consumption of brown as well as of white sugar; and the system, though wrong in theory, answered very well while an extra protection duty was levied on foreign refined. Since the imposition of the 12s. 10d. in place of the 18s. 4d. rate, the practice has to some extent been abandoned by our refiners, to enable them to keep the Dutch and French goods out of the market, but we might surely with profit use a stronger sugar for refining. Some light has recently been thrown on the kinds most suited to the refiner by the examinations carried on with polarized light by M. Emile Monier, into the constitution of sugar, and published in his work, "Guide pour l'Essai et l'Analyse des Sucres." (Paris: E. Lacroix.) This book contains a perfect mine of information for refiners, and it would seem that the polariscope, or optical saccharometer, by which the results given are arrived at, is not nearly so well known among us as it ought to be. By the use of this delicate instrument the saccharine richness of sugar can be shown to the minutest fraction, and the system of classification by shades of colour, or of types, is shown to be entirely delusive. A yellow sugar, of which the crystals are clear and good, is often richer than a white sugar of which the crystals are hardly formed, or badly defined. The richness also varies in samples of sugar of the same shade of colour. Thus, No. 12 of French beetroot sugar contains from 92 to 97 per cent. of crystallizable sugar—a difference of 4 per cent. in richness and a margin of 4 francs in the buying price. At the same time this sugar (No. 12), when good, contains 97 per cent., or the same saccharine richness as some samples of Nos. 18 and 19, worth 4s. or 5s. per cwt. more in the market. We propose to return to the light thrown by M. Monier's figures on the sugar duties in a future article, and at present to notice his conclusions on the relative richness of sugar. M. Monier states that beetroot sugar, as presented in the market, is richer than any other kind of saccharine matter, and gives the greatest yield when refined. The principal distinction between cane and beetroot sugar is, that the former contains 10 to 15 times as much glucose or incrystallizable sugar. Independent testimony to the superiority of the beetroot to the cane sugar is given by Mr. Barron, in his report upon the Belgian Sugar Industry ("Reports of the Secretaries of Legation," No. 6, page 208:—"Beetroot sugar is preferred by the refiners for the volume and whiteness of its yield. In refining it gives a much larger yield in loaves than Havana or Jamaica sugar." After the beetroot, M. Monier places the sugars of Java, Cuba, Mauritius, and Bourbon; and last, those of Martinique, Gaudaloupe, and Porto Rico. We should be curious to know where M. Monier would place the lower classes of British West India sugars, on which he has apparently made no experiments. We fear they would end his list. These analyses throw considerable light on the question of why the foreign refiner can produce loaf sugar more cheaply than the English—it is by the use of beetroot, Java, Cuba, and Mauritius sugars—instead of inferior kinds. The interest taken by the trade in the imports of beetroot will be added to, as the refiner makes more loaf sugar from it. With some approach to free trade in sugar, English refiners must be ready to make changes in their manufacture, or they will continue to lose ground. In the revenue returns for the year 1864–5, a charge appears for native British sugar, and this item has led to some speculation, on the part of those interested in the subject, as to whether beetroot had again been tried in England. That starch sugar was made in this city was certainly not generally known, as it was thought that the manufacture was prohibited by the excise. The following extract from the *Times*, however, shows that a general misapprehension existed on the subject:—"British-made sugar has long held a merely nominal place in our list of exciseable articles, but in the past year two manu-

factories of glucose, or starch sugar, have been established in London. The quantity brought to charge in the financial year 1864-65 was 1,064 cwts. The materials from which this sugar is made are chiefly sago and potato starch. It has but little resemblance to cane sugar, and less sweetness than the lowest class of colonial sugars. The rate of duty with which it has been charged is 9s. 4d. per cwt., being that on yellow Muscovado, or brown clayed sugar. It is stated that it is intended to be used in brewing. The imposition of the 9s. 4d. rate on sugar possessing so little saccharine matter gives a new instance of the injustice of the scale of duties.

Colonies.

Wheat in South Australia.—The acreage of the wheat crop last year amounted to 390,836 acres, or two-thirds of the total cultivated land. In 1863–4 there were 335,758 acres under wheat, or 60 per cent. of the tilled land; the increase this season, therefore, amounts to 6 per cent. The total produce of the harvest was 4,252,949 bushels, compared with 4,691,919 bushels in the yield of the previous harvest, showing a decrease of 438,970 bushels, the average yield per acre being only 11 bushels as against 14 bushels last, and one bushel less than the average of the last seven years. There is no doubt but that the low average of the South Australian wheat crop is owing to the imperfect cultivation of a great portion of the land; many small holders are compelled to plough and sow the same ground year after year, without any intermission or attempt to replenish the soil by fallowing or other means, resulting in a very low return, and thus reducing the average result of the whole colony, which is invariably exceeded by the better class of farmers, whose more extensive holdings enable them to pursue a systematic plan of operations, in which more careful tillage, rest for the soil, and a combination with stock farming are stated to be essential to, and generally productive of, success. Seven-eighths of the wheat crop was reaped by machine, being less than last year, notwithstanding the increased cultivation. The most important advantage our farmers possess over those of the sister colonies is the expedition and economy with which their crops can be gathered, owing to the successful method of the reaping machines now universally used on all but hilly ground, permitting of the grain being reaped, winnowed, cleaned and bagged on the harvest-field, and removed into the store ere the day is closed. The high prices ruling for wheat have caused the farmers to look more particularly to their grain crop for profit, and had the effect of reducing the breadth laid down for hay by 9,020 acres, the total area sown being only 66,570, compared with 75,590 acres the previous year; and, as the average yield was 4 cwt. less—say 23 cwt. instead of 27 cwt. per acre, the deficiency in the crop is very large, no less than 25,637 tons; the total quantity grown being 76,656 tons, against 102,293 tons in 1863–4, showing a falling off of one-fourth.

Education in South Australia.—The Report of the South Australian Board of Education for the year 1864 has been published in the Colonial Government *Gazette*. It shows that during the year there was an increase of 20 schools and 1,190 scholars on the previous year. The average number of schools for the year was 258, and the number of scholars on the rolls, 11,511, being an increase of 817 scholars on the previous year. The following table exhibits the number of scholars at their most favourable season, with their increase or decrease on the previous year, the number of licensed teachers being equal to the number of schools:—

	Boys.	Girls.	Total.
Adelaide	939	624	1,503
Corporate Towns	631	303	994
Country	5,476	4,926	10,402
	7,046	5,913	12,959

The amount expended by the Board in stipends to teachers was £12,914, or on an average £48 7s. 4d. for each teacher, and an average of 19s. 11d. for each scholar, against £1 3s. for the year previous. The aggregate amount of school fees received by teachers from parents, &c., of 11,954 scholars, not including 1,005 destitute, for which the fees are paid by the Board, nor for evening scholars, was £12,555 10s. The entire cost of education at the public schools, exclusive of all expenses, is shown to be £26,476 3s., or an average of £2 0s. 10d. for each scholar, against £2 1s. for 1863. This also gives the entire average receipt of each of the 258 teachers, the average number for the year £102 12s. 4¾d. against £101 7s. 7d. for 1863.

Notes.

Paris Exhibition of 1867.—The Imperial Commission has confirmed, by public notification, the report concerning the plan to be adopted with respect to the motive power to be employed at the Exhibition. Instead of concentrating the generators and motive engines on one spot, as in the case of former Exhibitions, the Imperial Commission deems it preferable to distribute them in several distinct buildings around the palace, in order to give increased facilities, and at the same time more security against accidents or interruption in the service. It has decided also that the power shall be supplied, not by the Commission, but by private engineers and contractors, who will be invited, on certain conditions, to set up one or more groups of generators, with all the necessary means of transmitting power to the machinery to be driven. The contractors for this service will, as far as possible, be taken from the body of French and foreign exhibitors, and the boilers and driving machinery will form an integral portion of the Exhibition. The duty undertaken by each exhibitor of motive machinery is to be explicitly noted in the catalogue. The power may be obtained by steam or any other means offering sufficient guarantees. Of course, the exact details of the work to be undertaken cannot be given until the arrangements are more advanced, but those who desire to tender for the supply of motive power may consult a statement of the general conditions laid down by the Commission for such service, and now lying for reference at the offices of the Commission at the Palais de l'Industrie, in the Champs Elysées.

Exhibition of Fishing Appliances.—The Prefect of the Pas de Calais has established an international exhibition of fish and fishing appliances at Boulogne-sur-Mer, under the patronage of the Marquis de Chasseloup-Laubat, Minister of Marine. The object of the Prefect is to give the fishermen in his department an opportunity of learning the manner in which fish are caught in other countries, both in salt and fresh water. It may be interesting to state that the Society of Arts, nearly one hundred years since, opened an exhibition of a similar character at its house in London, for the purpose of instructing English fishermen in the methods employed by the Dutch in the turbot fishery, which was at that time wholly in their hands. And further, the Society offered the sum of £500, to be awarded as prizes of £5 and £3 for each hundred of fish of given size, caught and brought to shore by English vessels. In order further to facilitate the learning of the art, each vessel was allowed to have one foreigner on board.

Asylum for the Middle Classes.—There exists in Paris and in other parts of France many excellent establishments for the relief of persons of small income, some of which take the form of hospitals and lunatic asylums, (maisons de santé), while others serve as retreats for the aged. One of the latter class has just been opened at Auteuil, near the Bois de Boulogne; it was established by the Administration of Public Assistance, with funds given by a gentleman and lady named Chardon-Lagache. The new asylum receives married couples, as well as single

persons, and the expenses are defrayed half by the inmates themselves or their friends, and half from the funds of the foundation. The establishment is arranged to accommodate two hundred persons, and it is already half full. The cost of the building—defrayed entirely by Monsieur and Madame Chardon-Lagache—was upwards of £60,000, and the ground upon which it stands—given by the Administration—is valued at about one-third of the above sum. The new asylum was formally inaugurated last week, in the presence of the founders and of the officers of the Administration, and the chapel appertaining to it was consecrated by the Abbé Surat, Archdeacon of Notre Dame.

Names of Streets in Paris.—An old street, with a long antiquated name, *Rue des Ecuries d'Artois*, so called from the fact of the stables of the Count d'Artois having originally occupied the site, is to be re-christened after the poet and romancist, Alfred de Vigny, who resided there for forty years in the same house. Few literary men have left a brighter or purer name than Alfred de Vigny. Many streets and boulevards in Paris are named after literary and scientific celebrities, French and foreign. Arago, Balzac, Byron, Béranger, Boileau, Beaumarchais, Bossuet, Buffon, Chérubini, Crébillon, Chateaubriand, Cuvier, Dalembert, Descartes, Dupuytren, Fénelon, Fontain, Fontenelle, Franklin, Fulton, Geoffroy St. Hilaire, La Harpe, Jacquard, Rousseau, Jean Gougon, Jussieu, La Bruyére, La Fontaine, Lavoisier, Richard Lenoir, Lulli, Masillon, Molière, Montesquieu, Montgolfier, Newton, Pascal, Rabelais, Racine, Réaumur, Regnier, Rossini, Say, Sedaine, Thénard, Watt, Volta, Voltaire, and many more. It is a popular and most economical mode of keeping the names of great men in the mind of the people.

International Postal Arrangements.—The French government loses no opportunity of improving its postal arrangements with foreign countries. Three decrees have just been published respecting conventions made between Switzerland, Prussia, and France. On and after the 1st of October, in the present year, the postage of a single letter weighing ten grammes, the third of an English ounce, passing between any part of France or Algeria and Switzerland, will be reduced to thirty centimes; at present the charge is equal to four pence per quarter ounce. At the same time, post-office orders will be exchangeable between the two countries, as they already are between France and Italy. The still more recent convention between France and Prussia will make no alteration in the postage of letters as regards Prussia proper, but will allow of the transmission of commercial and business papers at the rate of fifty centimes per two hundred grammes, or about five pence for rather more than six ounces and a half; it also establishes the exchange of money orders, not only between France and Prussia, but also between the former and the other States of Germany served directly by the Prussian post. No order is to exceed two hundred francs in amount, and the tare is fixed at twenty centimes for every ten francs. The establishment of the system of post-office orders between these four countries—France, Italy, Prussia, and Switzerland, affirms the principal of small payments by the means of the post, and there is little doubt that before long it will be extended over of the whole of Europe.

Patents.

From Commissioners of Patents Journal, October 6th.

GRANTS OF PROVISIONAL PROTECTION.

Bacon-curing rooms, cooling—2338—R. A. Boyd.
Blast furnaces—2413—R. A. Brooman.
Boots and shoes—2339—J. Dunbar.
Boots and shoes, water-proof soles for—2449—J. W. Coburn.
"Bourdon's" steam pressure guage, improvements on—1509—T. E. Wright.
Box-irons—2358—J. Whitehouse.
Bricks and tiles—2398—W. Porter.
Brooms and brushes—2386—G. Smith and C. Ritchie.
Carpets, &c., materials for—1775—J. and A. Longbottom.
Cartridges—2475—J. Broun.
Coke and charcoal ovens—2477—W. Morgans.
Cricket and other balls—2328—C. Huntley.
Docks and canals, caissons for closing—2364—H. Law.
Earth, machinery for excavating—2403—J. B. Hulme.
Elastic material, adaptation of—2423—M. Cartwright.
Fabrics, dyeing and printing—2327—J. Lightfoot.
Fire-arms and ordnance, rifling for—2354—W. B. E. Ellis.
Flags and stones, dressing—2411—B. Chaffer, and J. & C. Thompson.
Flues—2467—J. Hilliar.
Gas, generating illuminating—2435—J. H. Johnson.
Gas, generating illuminating—2439—A. V. Newton.
Gas, method of lighting—2308—A. Mackie and J. Paterson.
Grain, winnowing—2300—W. L. Wise.
Horse-shoes—2433—G. Davies.
Hydrostatic presses—2304—J. and W. Weems.
Invoices of goods conveyed by rail, securing—2407—E. W. Collier.
Lace—2312—W. E. Newton.
Locks—2360—R. A. Brooman.
Lubricating apparatus—2352—I. Beamish.
Noxious gases, deodorizing—2451—E. Brooke.
Oils and greases, insoluble—3390—I. S. McDougall.
Paddle wheel—2481—J. J. McComb.
Paper and envelopes, bordering—2441—J. Parkins.
Peat for fuel, preparing—2469—G. T. Bousfield.
Preserving food, &c., vessels for—2473—L. H. Gillet.
Railway plant to ensure the safety of passengers—2463—C. M. Kernot and N. Symons.
Reaping and mowing machines—2310—J. Brigham and R. Bickerton.
Reaping machines—2324—C. T. Burgess.
Safes—2318—A. E. Nordenskiold and J. W. Smith.
Safes—2457—C. Parigot and A. Grivel.
Sewing machines—2169—D. Macpherson.
Ships and boats, propellers for—2258—R. Davies.
Ships, cleansing and coating the bottoms of—2316—R. P. Roberts.
Smoke, consumption of—2405—W. Watkin.
Smoking pipes and cigar holders—2362—S. Myers.
Soda waste, obtaining sulphur from—2443—M. Schaffner.
Spinning and doubling, mules for—2342—J. Dodd.
Steam boilers, cleaning the tubes of—2346—S. Soutar.
Steam boilers, preventing incrustation of—2321—W. and S. Tyne and R. Clayton.
Steam engines—2479—J. R. Arnoldi.
Steam engines, condensing the steam of—2376—F. Daina.
Stirrup latch bar—2320—S. Davis.
Submarine telegraph cables—2326—S. Inkpen.
Sugar—2385—J. Fletcher.
Sugar decolorising vessels, supplying charcoal to—2292—J. Dawson.
Sugar, &c., decolouring—2409—W. Clark.
Swivels—2334—J. Welch.
Telegraphic conductors—2332—J. Macintosh.
Tiles, ornamentation of—2378—H. Venables.
Vessels, unloading—2302—W. Cory and J. H. Adams.
Washing machines and churns—2471—J. Taylor.
Water, purifying—2415—A. Bird.
White lead—2427—P. Spence.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Fire-arms, rifling—2488—W. E. Metford.
Telegraph cables—2509—J. A. Mee.

PATENTS SEALED.

1050. W. Weatherley.	1020. W. Brooks.
1011. A. G. Hunter.	1025. W. Clark.
1012. S. Moore.	1026. D. Payne.
1013. T. Turton.	1044. G. A. Montenat.
1018. R. A. Brooman.	1070. M. Smith.

From Commissioners of Patents Journal, October 10th.

PATENTS SEALED.

910. H. A. Bonneville.	1085. J. Gardner, R. Lee, G. H. Wain, S. Hargrove, and C. and S. Hargrove.
1042. H. Sikes.	1109. F. Wise.
1045. J. M. Hart.	1111. D. S. Buchanan.
1046. T. J. Mayall.	1125. E. Lord.
1047. F. Bapty and E. B. Sayers.	1175. J. W. Lowther.
1061. C. Turner.	1223. J. H. Johnson.
1063. T. Bennett.	1679. J. Gale.
1065. J. McDowall.	
1075. E. and G. H. Morgan.	
1077. A. W. Hale.	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2671. R. Broadbent.	2710. H. D. P. Cunningham.
2700. S. F. Cox.	2726. J. H. Johnson.
2818. J. Tangye.	2784. J. B. G. M. F. Piret.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2207. A. Bessemer.	2387. B. Goodfellow.
2212. G. Hamilton & W. H. Nash.	2787. J. Jobson.
2230. D. Naylor.	

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, OCTOBER 20, 1865. [No. 674. VOL. XIII.

TABLE OF CONTENTS.

Proceedings of the Society.

MUSICAL EDUCATION COMMITTEE.

The following report was drawn up in the Ministry of Public Education in Prussia, and has been received, through Earl Russell, from Her Majesty's Ambassador at Berlin:—

PRUSSIA.

The study of music in Prussia enjoys a considerable range, in consequence of the numerous private establishments, whose founders and managers do that which in many other states is done by public academies (*conservatoires*) at the expense of the State. Of such private establishments there are, for example, the Conservatoire of Music of Dr. Stern, the new Musical Academy of Professor Rullack, the Singing Academy, under the direction of Professor Grell, in Berlin, as well as the Conservatoire of Music in Cologne, founded by a company (*Verein*) of friends of music, which is under the Director of Music, Herr Hiller. There is no want of similar private institutions in other larger provincial towns. No official reports are made upon them. Occasional reports are made in the programme of the Stern and Rullack establishments. Till now there has been no State conservatoire for music in Prussia, and state money has only been exceptionally applied to such musical educational establishments, and more frequently for the support of extraordinary talents. With reference to the government provision for musical students, the Senate of the Berlin Academy of Arts has a section, whose members, Messieurs Bach, Grell, and Taubert, conduct the musical division of the Academy. The annual cost of this division, in which instruction is given in the theory of music and the art of composition, amounts to about 1,800 thalers. The number of pupils is not fixed.

In the Royal Institute of Church Music at Berlin, under the direction of Professor Bach, with four teachers, instruction is given to twenty pupils in organ playing, pianoforte playing, violin and singing, gratis, as well as in the theory and the history of music. The annual expense of this institution amounts to 2,897 thalers.

One academical musical institute exists at the Royal University at Breslau, having one director and two teachers, with salaries amounting to 450 dollars, and a similar one at Königsberg, with two teachers. Other universities have likewise offices of teachers of music.

Singing forms an element of education, at gymnasia schools, and other educational establishments. Instruction in music, that is, in organ playing, pianoforte playing, violin playing, and singing, is given in the schoolteachers' seminaries, at which the organists and choristers are educated, theoretically and practically, in music. Besides the above-named teaching schools of this character, there is a formation school for singing for the persons belonging to the cathedral choir (*dom choir*), and one for singing and instrumental music at the Royal Opera.

Berlin, the 5th July, 1865.

For the Minister of Public Education,
(Signed) LEHNERT.

To His Excellency Monsieur de Bismarck.

Proceedings of Institutions.

SOUTH STAFFORDSHIRE EDUCATIONAL ASSOCIATION.—The sixth annual meeting was held on the 4th October, under the auspices of the Willenhall Literary Institution, which last year invited the Society to pay a visit to Willenhall. Lord Lyttelton, who has been the President of the Association from its establishment, presided, and was supported by the Earl of Lichfield. The following delegates from Institutions were present:—Stourbridge Ironworks Institute, Mr. George Hipwood, Mr. Robert Bill. Messrs. Chance's Library, Mr. F. Talbot. West Bromwich Christian Institute, Mr. Henry Ward. Wednesbury Mechanics' Institute, Mr. Sampson Lloyd, and Mr. R. Williams. Wednesbury Working Men's Club, Mr. Weimpress and Mr. Davies. Bilston Working Men's Club, Mr. John Hague. Bilston Institute, Rev. J. W. Bain and Mr. J. C. Tildesley. Willenhall Literary Institute, Mr. Chapelle. Dudley Geographical Society, Mr. H. Beckett and Mr. James Solly. Dudley Mechanics' Institute, Mr. E. Hollier, Mr. A. Shedden, and Mr. J. Williams. Pensnett Night School and Club, Rev. C. Farmer and Mr. Atkins. Woodside Mutual Improvement Society, Mr. Crompton. Cradley Heath Working Men's Club, Mr. Tromans. Corngreaves School, Mr. S. Griffiths. Gold's Hill, Rev. F. P. B. Hutton and Mr. Crabtree. Stourbridge Associated Institute, Rev. D. McGinnis, and Mr. W. Ryder. Kinver Young Men's Institute, Mr. Thomas Bolton, Mr. W. Yeomans, and Mr. B. Williams. Wolverhampton St. Peter's Night School, Rev. J. H. Iles. Walsall Church Institute, Mr. Vaughan and Mr. Webb. Wolverhampton Working Men's Club, Mr. Powell and Mr. Wilkins. Oldbury Working Men's Club, Mr. Spencer. Mr. Jones, the secretary of the Association,

read the report, of which the following is the substance: —"During the greater portion of the past year the operations of the Association have been carried on under considerable disadvantages, and the actual results of the past season are not, on the whole, so satisfactory as they have been in some previous years. At the time of the last annual meeting, the district was agitated by one of the severest labour disputes on record, and this was barely settled before a somewhat similar disturbance took place in another branch of the staple industries of the locality. The natural results of these contests between masters and men had the effect of diverting the attention of each body from any movement of a philanthropic or educational character. It is, however, highly satisfactory to find that, notwithstanding these adverse circumstances, institutions and evening schools were able to hold their ground, and the gross results of the year's work are much higher than might have been expected. After describing the Willenhall Institute building, recently opened, the report says the number of members has increased from 150 to nearly 400. At Brierley-hill, a public company has been formed for the purpose of erecting suitable institute accommodation, and the buildings are in active progress. At Oldbury, a Working Men's Club has been commenced, and is reported in a satisfactory condition. The Athenæum of Wolverhampton has been considerably enlarged, a commodious reading-room has been formed, and, as an amalgamation has been made between this society and the Alliance Literary Institute in the same town, the total number of members has greatly increased during the year. The St. John's Working Men's Club, Wolverhampton, has been in active and successful work throughout the whole year. On the other hand, the reports received from several institutions are of an unsatisfactory nature. The Wolverhampton Working Men's College has been suspended, owing to lack of students; and thus one of the most useful agencies in the district has, for a time at least, ceased its operations, which have been carried on with the most gratifying results for upwards of eight years. The Alliance Literary Institute and Christian Association, in the same town, has also broken up. Several other societies report that it is with difficulty that they have been able to keep open their doors at all, and state that if, in the approaching season, they are not more successful, they will be compelled to close. Though the general work carried on by institutions was not, on the whole, of a satisfactory nature last year, it is pleasing to note the number of evening schools throughout the district increased. The examinations carried on by the Association have been this year attended by a smaller number of candidates than last year. This diminution is from evening schools, and arises from the fact that the pupils from the Dudley Mechanics' Institution and the Amblecote Night School were examined by means of the Worcestershire Union Local Boards, though they worked the same papers. Several institutions are in union with both Unions of Institutes, and can elect to be examined by either. The total number attending the elementary examinations was this year 122, and of these 72 were placed upon the class list. The examiner states that he is able to report favourably of the quality of the answers of those candidates who have been successful; the best are very good indeed, and the whole of the first class in each grade are praiseworthy. For the Society of Arts final examinations the number of successful candidates was this year 54, but among these none obtained the distinction of a prize. The examinations of the Science and Art Department were attended by upwards of 50 students, and of these more than 40 were placed on the class list. Certain modifications having been suggested in the method of distributing the prizes and certificates to the successful candidates, it has been resolved, should it be approved at this meeting, to merely give out the local certificates, &c., at the place where the annual meeting is held, but to send the others to each examination centre, and to request the local board in each place to organise a public distribution meeting. As representations have been made from the managers of evening schools, &c., that a considerable stimulus would be given to the members preparing for the examinations were prizes offered to the candidates appearing at the head of each class list, the committee have resolved to expend a sum not exceeding £20 in such prizes at the examinations to be held in March next. With respect to the future work of the Association, it is proposed to hold during the winter a series of meetings somewhat similar to the one referred to as having been held at Wednesbury in February last. Arrangements have been made to have a conference and public meeting at Bilston, in November; and the committee suggest to managers of institutions the great desirability of having such meetings annually, at the commencement of the winter season. They also propose to hold during the winter several meetings of secretaries, in order to obtain frequent interchange of opinion upon the most important matters affecting institution work, and to issue occasional papers, in which the proceedings of the associated institutions will be briefly recorded. In giving effect to these proposals, the active co-operation of the managers of institutions is particularly invited, as without their zealous assistance and united action throughout the whole district they can hardly expect that what they are intending to do will be successful. The committee hope that by these and other means the institutions of the district may be encouraged to more energetic action during the present winter, and that at the next meeting of the Association the reports presented may be of a more uniformly satisfactory character than they have been for the past season."

EXAMINATION PAPERS, 1865.

(*Continued from page* 682.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

SPANISH.

THREE HOURS ALLOWED.

Part I.

Candidates for the First-class Certificate will have to translate the following passage into Spanish, to render into English or French the idiomatic phrases, and to write a short essay:—

Lope de Vega is called a prodigy of nature, and such he really may be reckoned, not that we can ascribe to him a sublime genius, or a mind abounding with fine original thought; but his fertility of invention and readiness of versifying are beyond competition. He required no more than four-and-twenty hours to write a versified drama of three acts, interspersed with sonnets, and abounding in intrigue. This astonishing facility enabled him to supply the Spanish theatre with more than two thousand original dramas. In general the theatrical manager carried away what he wrote before he had even time to revise it; and immediately a fresh applicant would arrive to prevail on him to commence a new piece. According to his own opinion he wrote on an average five sheets a-day, so that he must have written upwards of 21,300,000 verses.

This peculiar gift of rapid composition will appear more extraordinary when we attend to the nature of Lope's versification. At every step we meet with acrostics, echoes, and compositions of that perverted and laborious kind, which, though they require no genius, exact much time that one should think such a voluminous poet could little afford to waste.—*Hallam's History of Europe.*

Chistes.

Translate into English—El rey Don Alonso de Aragon decia que cinco cosas le agradaban mucho; lena seca para quemar; caballo viejo para cabalgar, vino anejo para beber, amigos ancianos para conversar, y libros antiguos para leer.

Un letrado leyendo un libro de secretos naturales en que decia que el hombre que tiene la barba ancha era senal de muy necio, tomó una vela en la mano para mirarse á un espejo, porque era de noche, y quemóse por descuido la mitad dela barba, y escribió luego al margen, Probatum est.

Idioms.

1. Ladrar contra la luna.
2. Dorar la pildora.
3. Piedra que rueda no coje musgo.
4. Buscar cinco pies al gato.
5. Tener un pie en la sepultura.
6. Dar palo de ciego.
7. Al buen entendedor pocas palabras.
8. Despedirse á la francesa.
9. Nó hay que mentar la soga en casa del ahorcado.
10. Por el dinero baila el perro.
11. En el pais de los ciegos el tuerto es el rey.
12. Hacer el caldo gordo.

Part II.

Candidates for the Second-class Certificate will have to translate six or seven of the above idioms, the following extract of Gil Blas, and the examples for the elucidation of grammatical questions:—

Blas de Santillana, mi padre, despues de haber servido muchos anos en los ejercitos de la monarquia Espanola, se retiró al lugar donde habia nacido. Casóse con una aldeana, y yo naci al mundo diez meses despues que se habian casado. Pasáronse á vivir á Oviedo, donde mi madre se acomodó por ama de gobierno, y mi padre por escudero. Como no tenian mas bienes que su salario, corria gran riesgo mi educacion de no haber sido la mejor, si Dios no me hubiere deparado un tio que era canonigo de aquella Iglesia. Llamabase Gil Perez, era hermano mayor de mi madre, y habia sido mi padrino. Figurate allá en tu imagination, lector mio, un hombre pequeno, de tres pies y medio de estatura, extraordinariamente gordo y con la cabeza zabullida entre los hombros, y hé aqui la vera efigie de mi tio. Por lo demas era un eclesiastico que solo pensaba en darse buena vida, quiero decir, en comer y tratarse bien para lo creal la suministraba suficientemente la renta de su prevenda.

1. Name the neuter article in Spanish. Example—Youth has not foresight of the future, experience of the past, nor moderation to conduct itself in the present.

2. What are the rules as to placing the adjectives before their nouns? Examples—The experienced pilot perceived (from afar) the towering summits of the mountains of Leucaba. The mild zephyrs, more powerful than the burning beams of the sun, preserved a grateful coolness.

3. When is the passive voice in English expressed in Spanish by prefixing the pronoun *se?* Examples—It has been said that the enemy will be surprised. The victory would have been gained by us, if our troops had not been twice repulsed.

Part III.

Candidates for the Third-class Certificate will have to translate half of the above extract from Gil Blas, to answer the grammatical questions, translating into Spanish their examples, and the following phrases:—

Let us have more indulgence. In order that I may have a benefice. The mother must have a mild temper. Are you right in telling such a history? I am wrong in speaking to you. Will your children be afraid at home? We are neither right nor wrong in hearing his reproaches. Let them all suffer the punishment, though only one may deserve it. Many shut their ears to the voice of conscience. They distribute their property among the poor. From that place they hear every thing easily. He died the following day. The groans attracted the attention of the hearers.

FREE-HAND DRAWING.

THREE HOURS ALLOWED.

Make a copy of the whole or part of one of the drawings which you have brought with you, so that the Examiner may judge whether the original work is your own doing. If you have not brought a drawing make a repetition from memory of any studies you have made during the last twelve months; the original drawings should be sent in afterwards.

Directions for the Local Boards.

Notice should be given to the candidates for examination in free-hand drawing, that they should bring any studies which they have finished during the last twelve months, as proofs of their abilities.

NATIONAL PORTRAIT EXHIBITION IN 1866.

In accordance with the suggestions made in a letter from the Earl of Derby, published in the *Journal* in June last (p. 541), the Lords of the Committee of Council on Education have determined to hold a National Portrait Exhibition at South Kensington, in the arcades overlooking the Royal Horticultural Society's Gardens, which will be opened in April, 1866. A Committee of Advice has been constituted, consisting of the Trustees of the National Portrait Gallery and other noblemen and gentlemen, the Earl of Derby being president.

The following are the arrangements approved for the Exhibition:—

1. The Exhibition is specially designed to illustrate English history and the progress of art in England. It may be divided into two or three sections, representing distinct historic periods exhibited in successive years, depending upon the number of the portraits received and the space available for their proper exhibition.

2. It will comprise the portraits of persons of every class who have in any way attained eminence or distinction in England, from the date of the earliest authentic portraits to the present time; but will not include the portraits of living persons, or portraits of a miniature character.

3. In regard to art, the works of inferior painters representing distinguished persons will be admitted; while the acknowledged works of eminent artists will be received, though the portrait is unknown, or does not represent a distinguished person.

4. The portraits of foreigners who have attained eminence or distinction in England will also be included, with portraits by foreign artists which represent persons so distinguished.

5. The Exhibition will be held at South Kensington, in the spacious brick building used for the refreshment rooms of the International Exhibition in 1862; and these galleries, which are perfectly dry, will be fitted up expressly for the Exhibition, and patrolled day and night by the police.

6. All charges for the conveyance of pictures accepted for exhibition by the Committee will be defrayed by the Department of Science and Art.

7. The Exhibition will be opened early in April, 1866. The portraits, for the purpose of proper arranging and cataloguing, will be received not later than the second week in February, and will be returned at the end of August at the latest; but, although the Exhibition will continue open till that time, any owner who requires the return of his contributions at the end of July will have them forwarded to him at once.

8. In accordance with the usual practice, the Science and Art Department, unless the owner objects, will take photographs of such portraits as may be useful for instruction in the Schools of Art, and allow them to be sold in the Museum; but no permission will be granted to any private person to photograph, without the owner's express sanction. Two copies of each photograph taken will be presented to the owner of the picture photographed.

9. As was the case at the Exhibitions of 1861 and 1862 (and as is usual at the Royal Academy and other exhibitions), the department cannot be responsible for loss or damage, but every possible care will be taken of works

lent; and it may be added that the numerous paintings lent for exhibition in 1862 were collected and returned by the same agency as will be now employed, free from any injury or damage of any kind.

10. All correspondence marked on the cover "National Portrait Exhibition," should be addressed to the Secretary of the Science and Art Department, South Kensington Museum, London, W.

Mr. Samuel Redgrave, to whose valuable labours the successful formation of the collection of portrait miniatures is chiefly due, has undertaken the special charge of directing the Exhibition, and Mr. Sketchley will act as Secretary.

BRITISH ASSOCIATION, 1865.

On Chain-testing Machines. By Sir W. G. Armstrong, C.B.

The following paper was read before the Mechanical Section:—

The engineering firm of which I am a member, having been entrusted with the construction of the apparatus for testing chain cables and anchors, lately established at Birkenhead by the Mersey Harbour Trustees, had occasion to enter into a very careful consideration of the conditions requisite for effecting the operation in the best possible manner. As public attention has been forcibly directed of late to the importance of more accurate methods of testing chains and anchors, a few observations on the subject of the Birkenhead machine will not at the present moment be mistimed.

The most important consideration in the construction of a chain-testing machine is to obtain an accurate indication of the strain upon the chain. The hydraulic press has been for many years the appliance usually employed for exerting the strain, and nothing can be better fitted for the purpose; but the methods of determining the amount of the strain have been extremely imperfect. Most commonly the strain has been estimated by the indications of a mitred valve pressed down by a lever and weight. The impossibility, however, of restricting the tightening surface of the valve to a definite annular line, so as to exclude any variation of area, rendered this mode of indi cation highly delusive; so much so, indeed, that the attendants generally paid more regard to the indication afforded by the crackling of the scale on the surface of the iron than to the amount of load upon the valve. By substituting a loaded plunger for a loaded valve the uncertainty arising from variability of surface is obviated, but a plunger requires a packing to make it water-tight, and the effect of the friction of this packing has to be considered in relation to the friction of the press. A plunger without friction would give untrue indications of the strain, unless the press were also without friction; but friction cannot be avoided in the press, and therefore friction becomes a necessary element of accuracy in an indicating plunger. To make this more apparent it is only necessary to consider that in the press the friction of the packing lessens the tension exerted on the chain, while in the case of the indicator the friction of the packing lessens the weight necessary to indicate the pressure. If, therefore, these two frictions be in harmony, the load on the indicator will be diminished in the same proportion as the tension on the chain, and thus a direct indication of the strain upon the chain will be obtained.

The proper and usual packing for the hydraulic press is a cupped leather, but as the lip of the leather is pressed against the surface of the ram by the action of the water, the amount of its friction varies directly as the pressure. It is therefore necessary that the indicating plunger should also be packed with a cupped leather, in order that its friction may likewise vary directly as the pressure. But as the ratio of circumference to area is very much greater in the small ram of the indicator than in the large ram of the press, it is obvious that with similar leathers the relative friction would be widely different in the two cases. The friction may, however, be brought to a proper adjustment by reducing the breadth of the lip in the leather of the indicator until its friction is in unison with that of the press leather. This adjustment should be made when the press ram and the indicator plunger are both perfectly clean and free from any lubricating substance, and in no subsequent use of the machine should either oil or grease be applied to these parts. The effect of employing a lubricator is to diminish the friction in the first instance, but afterwards to increase it, because the unctuous character of the lubricant is soon exchanged for a stickiness which produces an opposite effect. In fact, when grease or oil are used the frictions become so irregular as to render impossible an accurate correspondence between the press and the indicator.

There is another desideratum in the testing of chains which requires a further elaboration of the indicating apparatus. When a chain breaks in the test it is desirable to show not only that it failed to bear the full test strain, but also what was the amount of strain exerted at the moment of fracture. In the case of the Birkenhead machine, various indicators, upon the principle of those commonly used for steam pressure, were tried for the purpose of effecting this latter object, but none of them gave satisfactory results. An apparatus was therefore designed for the object, which has since come into very general use, under the name of the "pendulum indicator." In this apparatus the pressure upon the indicating plunger is exhibited by the travel of a pendulum through a graduated arc. The movement is communicated from the plunger to the pendulum through the medium of a compound lever. When a chain breaks the pendulum falls back until stopped by a ratchet, but leaves a marker at the exact point on the scale attained by the pendulum at the moment of rupture.

I have hitherto spoken of friction only in reference to the packing of the apparatus. This friction, as I have already stated, varies with the pressure, but there is also the constant friction due to the weight of the moving parts to consider. If the machine be used exclusively for high strains in relation to its weight, this constant friction will be unimportant, but if a heavy machine be used for testing light chains, a considerable element of error will be introduced, unless a proportionate friction of the same constant character be added to the indicator. Still, however, it is better that very heavy machines should not be used for testing very light chains, unless they be constructed with more than one press, to act separately for light chains and conjointly for heavy chains. With this view, the Birkenhead machine has three presses, the centre one being used alone for light strains, and the three acting in concert when great strains are to be exerted.

Although an hydraulic indicator, properly constructed and correctly adjusted in regard to its friction, may be safely relied upon as indicating with sufficient precision the strain exercised by the machine; yet, for the purpose of ascertaining in the first instance when correct adjustment has been attained, and also for detecting any discrepancy which may subsequently arise from dirt upon the ram or plunger, or from any other cause producing irregular friction, it is necessary that every machine should be provided with a lever indicator, to which the strain may be immediately applied, and the strain ascertained by the lifting of a weight. Such an apparatus requires to be accurately fitted with knife-edge bearings, in order to afford delicate indications, but, as these are liable to deterioration by too frequent use, it is better to reserve the lever apparatus as a standard of reference for adjusting the hydraulic indicator, which is not liable to deterioration by use. It is not necessary that the lever indicator should range as high as the hydraulic indicator, for, if the two indicators register alike through a sufficient series of the lower strains, no discrepancy would be manifested

if the comparison were carried to the highest powers of the machine.

I may here mention that nothing so soon deteriorates the lever apparatus as inadequate length of the knife-edges in relation to the strain upon them. The conclusion arrived at in the Elswick Works is, that not less than one-inch length of edge should be allowed to every five tons of strain upon the bearing.

In the arrangement of a public chain-testing establishment, it is desirable that the apparatus for the various operations should be placed in such succession as will allow the chains to move from process to process without any retrogression. The Birkenhead Chain-testing Establishment commences with a store room for the reception of unproved chains. From this store each chain is dragged by a steam-power capstan through an opening in the partition-wall on to the testing-bench of the machine. It is there made fast—at the one end to the press and at the other to the cross-head, supported on live rollers, which cross-head may either abut against a stop or be connected with the lever indicator. After the chain has been proved it is dragged by a second capstan directly forward in the same line into the examining-room, and there stretched upon one of the benches, where it undergoes a close inspection. If found perfect, it is then hauled forward by a third capstan through the heating oven and blocking trough, and is thence passed complete into the delivery store at the opposite end of the establishment. The course of the chain being thus in one straight line, it is necessary to carry it over the machinery at each end of the testing-bench, and to accomplish this a channel of wrought iron is fixed over the machinery to support the chain in its passage. Should the chain fail in the test, or be found defective on examination, it is drawn off by one of the capstans to the smiths' fires, placed on the floor of the examining-room, and after repair is again hauled to the testing-bench for a second proof. For the convenience of handling heavy chains at the smiths' fires a hydraulic crane is connected with each fire. Between the testing and examining rooms there is an intermediate room, called the Indicator-room, in which the lever and hydraulic indicators are placed, and the valves of the apparatus manipulated by an attendant in view of the indicators.

Anchors are received into the same store-room as the chains, and the usual appliances are provided for fixing them in the test. Over-head cranes are employed for lifting the anchors, as well as for lifting the chains in the two stores.

There are two testing machines in the establishment, fixed at opposite sides of the room. These are similarly arranged in every respect, but one of them is adapted to test up to a strain of 200 tons and the other to 300 tons.

The hydraulic pressure is supplied from a neighbouring accumulator, used for a system of hydraulic machinery, at work in the adjacent dock.

As the general practice is to make chain cable in lengths of fifteen fathoms, the Birkenhead machines are adapted for that length. The Board of Trade have recently fixed upon that length as the limit of length of chain to be tested at one time. The propriety of their so doing has been called in question, but I may state that it is the opinion of those persons who have the management of the Birkenhead machines, that no advantage of any kind would be gained by testing chains in greater lengths. If there is to be a limit, it is clear that such limit is best fixed at the length at which chains are usually made. There is, besides, a positive objection to exceeding that limit, because a greater length than fifteen fathoms cannot be tested without the use of intermediate supports, which, whether they be slides or rollers, are objectionable as being liable to produce variations of strain in different parts of the chain.

Another objection to permitting indefinite lengths of chain to be tested at one time arises out of the stretch to which chains are subject in testing. This stretch occasionally amounts to five feet in fifteen fathoms, and if that length of chain were greatly exceeded, it would involve a press of very inconvenient length, or necessitate taking repeated holds of the chain, which would be highly objectionable. I think, therefore, that the Board of Trade have acted wisely in imposing a limit, and in fixing that limit at fifteen fathoms.

On a New Method of Measuring Electrical Resistances, applied by Messrs. Siemens.—By Robert Sabine and Louis Schwendler.

The following was read in Section A:—

The insulation of submarine telegraph cables was, until the Red Sea and Indian lines were submerged, in 1859, determined qualitatively by the simple deflection of a galvanometer needle. If the deflection obtained, when the further end of the cable was in air, was very small in comparison with that obtained when the end was to earth, the cable was pronounced good; no deflection indicated a very good cable; and a great deflection an indifferent one.

A most decided step in advance of this crude method was made by Messrs. Siemens. It consisted in regarding the insulater as a bad conductor whose resistance could be expressed in the same measure as that of the copper line; and Mr. Fleeming Jenkin, about the same time, appears to have made experiments with the same end in view.

The manufacture of the core of the Malta-Alexandria cable, with the scrupulous surveillance of its electrical conditions, forms an era in cable work. Messrs. Siemens, who were entrusted by the Government with the duties of electricians, may be said to have then first established with success the science of cable-testing.

The system of tests applied to the single lengths of the core at the gutta-percha works gave their resistances of insulation and conductor, at a uniform temperature of 24°C., in the same units of measure.

As the whole of the cable was tested daily also at the Sheathing Works at Greenwich, as it grew in the tanks, from one to some hundreds of knots in length, it was necessary that the system of measurement should be equally exact, and applicable to long as to short lengths.

When the length of a cable is great, or its insulation indifferent, the value of the latter may be ascertained by the same method as that used in measuring the copper resistance — that of Wheatstone's bridge. But when the insulation exceeds a million units, this method becomes no longer available, on account of the differences between the currents in the four sides. It is therefore necessary to have recourse to a method less limited. For this purpose the deflection of a magnet-needle is observed, when the measuring battery, cable, and galvanometer are alone in the circuit; the constant of sensibility of the instrument being ascertained by the substitution of a unit of resistance and of electro-motive force for the cable and the measuring battery.

With a delicate galvanometer—such as Dubois' sine or Thompson's reflecting instrument—and a sufficient battery power, this method is available for measuring the highest resistances which have to be determined in cable-work. It is found, however, to be less adapted to the determination of resistances of a value lower than four or five millions of units; to be inconvenient on board ship during the submersion of a cable; and to be always burthened with a certain amount of tedious calculation. It was therefore necessary to seek for another method which would combine the simplicity and accuracy of Wheatstone's bridge with a higher range. The method determined upon was a modification of the common differential galvanometer. The equality of the coils was abandoned, and the relation of their magnetic forces upon the needle system only ascertained as a constant of sensibility.

As early as 1860, one of us used, in cable measurements, at Greenwich, a differential galvanometer with two coils,

one of which exerted two thousand times more deflective force upon the needle than the other. The cable and the measuring battery were inserted in the circuit of the larger helix and a single element, with a set of resistance-coils in that of the less sensitive helix of the instrument. The resistance in the latter circuit was altered until the magnetic forces of the two currents upon the needle were equal and opposite, and the pointer rested over the zero line of the card. The manipulation was simple, and the necessary calculations reduced to the mere multiplication of the value of the resistance inserted in the smaller circuit with the constant of sensibility and the relation of the electro-motive forces.

This method was found to answer well, being quite as delicate as the bridge, as unlimited as the method of deflection, and, at the same time, having the advantage of being totally independent of the magnetism of the needles. It has, therefore, been used very generally by us in cable and other measurements since that time.

On the occasion of fitting out the Carthagena cable expedition, it was considered desirable, in measurements of insulation on board ship, to dispense entirely with mathematical reductions, and to read off the resistances directly from the instrument.

It is easily understood that, to establish an equilibrium between the magnetic forces of the currents in the coils, it is not absolutely necessary to alter either of the currents; the same may be done equally well by altering the relative distances of the coils from the needle. This is the principle on which the new method forming the subject of this communication is based. The mechanical construction of the instrument is very simple; the magnetic needle system is suspended by a fibre of unspun silk between about 10,000 turns of a long, thin, well-insulated copper wire; its position being indicated by an aluminium pointer fixed across the same axis, moving over a dial-card, and observed through a magnifying glass.

Outside the case of the instrument is a horizontal metal stage, on which a vertical coil of copper wire is moved to and from the needle by means of a micrometer screw. This is the coil whose distance from the needle is varied, in order to make its deflecting power equal, at any moment, to that of the stationary coil. Its distance is observed with the aid of a scale engraved on the side of the metal stage which it travels over. The whole instrument stands upon a tripod with three adjusting screws. Its remaining mechanical arrangements differ slightly, in some points, from those of other instruments—greater facilities being given to the operator for centering the needle system and for levelling the instrument.

We will now give a sketch of the theory of the method and of its use in cable-testing.

Suppose two galvanic currents circulate in the two coils —the stationary and the moveable one—in opposite directions; they will oppose each other in their effects upon the needle, which will take up a position at an angle less than that which it would if the stronger coil were alone active. By altering the position of one of the coils a point is reached where the deflective force of one coil is made to exactly counterbalance the force of the other, or the needle returns to zero.

We will call the magnetic force of the stationary coil, with a unit of current upon the needle, m; that of the movement coil, with an equal current, $-n$. Further, when the balance is established by unequal currents, let these currents be, s, in the stationary, and s' in the moveable coil.

Then the magnetic force of the current in the stationary coil will be

$$ms,$$

and that in the moveable coil

$$-ns',$$

which, together, neutralise each other, or the sum

$$ms - ns' = 0.$$

The relation $\frac{m}{n}$ of the magnetic force of the coil is

$$\frac{m}{n} = \frac{s'}{s} = a$$

a being a constant of sensibility of the instrument for only one certain position of the moveable coil. The greater the distance of the latter from the needle system, the greater becomes the value of a; because n is variable with the position of the moveable coil, decreasing, according to the theory of magnetic forces, as some function of the distances of the coil from the needle increases. Therefore, the value of a for any given distance, d, of the coil from the needle would be

$$a = m\,F(d)$$

As the function, F, however, is a very complicated one, where the distances are not very great in comparison with the lengths of coil and needle, it is necessary, in practice, to ascertain experimentally the value of a for every division of the scale.

Being thus in possession of the constant of sensibility for every position of the moveable coil, let us imagine next two separate circuits; one includes the stationary coil, a battery whose electro-motive force is E, and the resistance, x, of the cable insulator; the other circuit includes the moveable coil and an element where electro-motive force is e.

We have, then, in the cable circuit, the current, S,

$$S = \frac{E}{x + r} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

in which r is the resistance of the battery and instrument.

In the moveable coil the current is s'

$$s' = \frac{e}{r'} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

r' being the instrument and battery resistance in this circuit.

The currents in the two coils, tending to deflect the needle system in opposite directions, if the distance of the moveable bobbin be altered sufficiently, the needle may be brought to zero, and we have the equation

$$\frac{s'}{S} = a \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

From (1), (2), and (3), the constant a is

$$a = \frac{e}{E} \cdot \frac{x + r}{r'}$$

and the resistance, x, of the cable insulator,

$$x = a \cdot \frac{E}{e} \cdot r' - r$$

Usually, r is very small in comparison with x; it may, without appreciable error, be neglected, and the resistance of the cable be expressed by,

$$x = a \frac{E}{e} r'$$

With the aid of this formula a table is constructed, $\frac{E}{e}$ and r' being constant quantities, and the value of a known for every division of the engraved scale.

To measure the resistance of a cable with this instrument, therefore, nothing more is necessary than to put it in circuit with the larger coil and its battery, E, and to vary the distance of the moveable coil until equilibrium is obtained. The distance is read off, and the table supplies the corresponding resistance in units.

VOLUNTEER FIRE BRIGADE.

The New York correspondent of the *Standard* gives the following:—Of late the city has been disgraced by firemen's fights, one or two of which have been of a de-

cidedly sanguinary character—one, indeed, rising to the proportion of a riot, and requiring in its suppression the charges and batons of some 300 policemen. Until within the last few weeks the checking of fires in the metropolis has depended entirely upon the efforts of volunteers, organised after a fashion, having their distinctive company names, and governed by a marshal elected by themselves. The five departments under this system became at last a gigantic political "machine;" its members were simply red-shirted ruffians (generally speaking), exercising complete terrorism at the polls in many of the election districts, and oftentimes completely bidding defiance to law and order. Their riots in the streets and at their "engine-houses," their robberies on the highway, and their general Thuggism, in time more than counterbalanced the undoubted gallantry and heroism they displayed at the numerous conflagrations with which our city has been visited, so that a paid fire department becomes absolutely necessary. The law authorising such an organisation was passed by the last legislature, and, after many ups and downs, the new force has been placed in action. The system just inaugurated has met with the open or covert opposition of hundreds of the volunteers, the worst class excited to such hostility by the ward and grog shop politicians, who saw that a paid department would put an end to their hopes of office. The rivalry existing between the various companies, always productive of evil, sprang at once into the shape of open battles. Thus, on the morning of Sunday, the 20th of August, a riot occurred in the Thirteenth Ward in this city, which at one time bade fair to equal the most sanguinary battles in our municipal history. The members of Engine Companies Six and Forty-one met by preconcert, and fell upon each other with great fury. Each fireman was armed with pistol or loaded club, or with both; and each company "blazed away" with revolvers at the other until the ammunition gave out, and then came to close quarters. Happily, under the circumstances, the belligerents were very poor marksmen, for but one man was killed outright, and two mortally wounded. The police of three precincts gathered and charged upon the combatants, and finally put them to flight. Both companies have been disbanded. As is usual in such cases, all the victims of the riot were spectators, none of the active participants being dangerously injured. On Friday evening last another battle, not so sanguinary, but for a time quite as determined, took place, the belligerents being members of Engine Companies Forty-six and Twenty-one. These street fights, fearful as they are, are not, however, the most significant proof of the utterly lawless character of our volunteer firemen. Their hostility to the new system is most startingly betrayed in the extraordinary increase in incendiary fires noticed within the first six months of the year. During the half-year ending in June there were 82 fires of incendiary origin; and there were, in addition, 18 attempts at incendiarism. There were during this time 39 arrests on charges of arson, or attempts to commit that crime. Two of the persons arrested were convicted and sent to the state prison; seventeen were discharged by the grand jury or by police magistrates; six were indicted, and are now awaiting their trial; four were held to bail; two were discharged on their own recognisances; one was held as a witness; and seven stand committed pending an examination. By these known incendiary fires two persons have lost their lives. The people pray most devoutly for the complete establishment of the paid system, as, indeed, they have reason to do. But the malcontents of the old department mean to make all the mischief they can before they are driven out; and it is highly probable that the police will have heavy work to do before the last vestiges of the volunteer system are destroyed. It is a well known fact—and a powerful argument in favour of a paid system, adduced by the police commissioners in their examination by the legislative committee last winter—that in the great riot of 1863 many of the firemen bore an active part, in some instances whole companies going over to the mob, and acting the *role* of incendiaries. I doubt if in any other city save job-ridden New York it would have been possible for such a monster organisation of outlaws and desperadoes to exist, under sanction and protection of the law, and enjoying peculiar privileges and immunities.

Fine Arts.

Paris Exhibition of Industrial Art.—This exhibition, which has already been mentioned in the *Journal*, has grown, by subsequent additions, to great importance, and it may now be said, without hesitation, to form the finest collection of industrial art, retrospective, contemporary, and prospective, that Paris has yet witnessed. As regards the retrospective portion, the arrival of new contributions can scarcely yet be said to have ceased. Nearly the whole of the building, with the exception of that occupied by the permanent Algerian and colonial collections of the Government, is now filled with the treasures of past ages, the products of the present time, the works of industrial designers, and the studies of the pupils of the public schools. The ceramic arts occupy a large proportion of the space allotted to the past, and the collection is not only exceedingly extensive but also very choice. In the first place, the Union Centrale exhibits its own collection of Chinese, Japanese, Indian, Persian, and European porcelain and *faïences*, including many rare specimens, with labels, bearing the date and place of production, with other particulars, useful to students and connoisseurs; there is a large collection of Saxon ware of the seventeenth century, and of old Sèvres china, including a complete set, which belonged to the naturalist Buffon, and which is decorated with the birds that figured in his works, and a large number of pieces forming part of the two fine sets belonging to Madame du Barry. The collection of the works of Bernard Palissy and of the old potters of Rouen, Marseilles, and other places, of Italian ware of the sixteenth century, of decorated, gilded, and prismatic ware of all countries and ages, with a few examples of the art of Flaxman, and the ingenuity of Wedgwood, is perhaps the most extraordinary ever brought together under one roof; the specimens of large pieces of Rouen ware of the early, as well as of the grand epoch, and that of the decline of the art, could scarcely be surpassed; and the glass cases, containing the contributions of MM. Rothschild, Baron Schwiter, Salin, and other well-known collectors, abound in dishes and other pieces of ware, intended for the ordinary purposes of life, which are now preserved in frames, and equal in market value to the pictures of the great masters. The collection of enamels of Italian and French origin, in the sober grisaille of Limoges, or glowing in all the colours of the rainbow, representing subjects historical, religious, artistic, or merely fanciful, is equal in importance, if not in amount, to that of the ceramic wares, and a comparison of the best specimens of these with the works of French artists of the present day shows, in spite of the taste and ability exhibited in the latter, how far the art-workmen of the present day are, in matters of this kind, behind those of past ages. The specimens of ancient glass from the earliest rude productions to the pure forms of a later period, the beautiful prismatic effects and curious twisted and complicated decorations of a still later epoch, are numerous and in some cases unique. There are some fine specimens of metal work in the exhibition, from the rude locks of the earliest time, to the elaborate hammered, pierced, chased, and engraved work of the sixteenth century, when the material seems to have made little difference as regards the amount of art bestowed by the workman, and when a morsel of iron was converted almost into a jewel by the cunning hand of the artist; the smith, locksmith, cutler, and armourer, vied with the gold-

smith and the jeweller, and all left behind them the impress of the artistic period in which they lived and laboured. The arms and armour in the exhibition are of superlative excellence, and this is not surprising when it is known that the Emperor, and many of the most noted amateurs, have contributed their choicest specimens. The Imperial collection alone includes more than five hundred articles. There are more than twenty complete sets of armour, illustrating various periods of Italian, German, Saxon, and other art, and including some very curious examples of the tilting armour used in Germany, with all its grotesque complications. The great value of the collection lies in the ornamentation, and the number and beauty of the decorated specimens are remarkable—cuirasses, helmets, shields, swords, daggers, halberds, battle-axes, maces, spurs, powder-flasks—exhibiting every variety of ornament, hammered, chased, engraved, pierced, inlaid, niello, and gilt-work of the various periods of Oriental, Italian, German, and French art, and so exhibited that every detail may be seen without an effort. The collection includes a vast number of fine bronze figures and ornaments, Greek, Roman, Gallo-Roman, French, Italian and German; series of gold coins of remarkable beauty, illustrative of ancient and modern engraving; curious old German silver ware of the seventeenth century; many of the choicest specimens of the enamels of Petitot and other artists on snuff-boxes, comfit-boxes, and other articles of the kind; beautiful examples of carved work, in ivory and wood, of all countries and periods; cabinets and articles of furniture, carved, inlaid, and decorated in every possible style, from the church and other furniture of the middle ages down to the rococo productions of the eighteenth century; tapestry, brocades, embroidery, lace, and other work of every country in the world, Asiatic as well as European. In fact, there is scarcely a single industrial art of any period, or of any country, which is not fairly represented in this remarkable exhibition. It is unfortunate that circumstances have not permitted the management to publish a catalogue of the whole collection, but the late arrival of many of the contributions evidently rendered this impossible to the present moment. Catalogues have appeared of the modern portion of the collection, and of the Imperial collection of arms, and others are promised shortly. The Exhibition is announced to remain open until the end of November.

Exhibition of Works of Art in Venice.—The Venetian Society for the Promotion of the Fine Arts announces the organisation of a permanent exhibition of works of art under its auspices. Foreign artists are admitted as exhibitors, but must bear the whole charge of transporting their works to and from Venice. They are to be addressed to the Presidenza della Società Veneta Promotrice di Belle Arti, Palazzo Mocenigo a S. Benedetto, Anagrafico, No. 3,980. Each series of contributions will remain on view for two months.

Exhibition at Versailles.—The Annual Exhibition of the Society of the Friends of the Arts of the Seine-et-Oise, was to open on the 8th instant.

Scandinavian Exhibition.—The difficulty which occurred in consequence of the determination of Sweden and Denmark to hold exhibitions of Scandinavian industry in their respective capitals at the same period, has been met by the abandonment of the project, for the present, on the part of the authorities of the latter country. The Stockholm exhibition, therefore, now stands alone, and is fixed to open, as announced in the *Journal* some weeks since, on the 15th of June, 1866.

Art Convention between France and Nassau.—The *Moniteur* announces the promulgation of a convention recently agreed to between France and the Duchy of Nassau for the reciprocal protection of property of works of art of literature.

Public Statues.—A double *fête* occurred the other day at Montbard, in the department of the Côte d'Or, when the supply of water to the town was inaugurated, and a statue of Buffon, the naturalist, erected some time since in the same town, was consecrated; the engineer of the water works is a grand-nephew of the *savant*, and both were born in the town where the ashes of the former repose. Discourses were delivered by the celebrated chemist, M. Chevreuil, director of the museums in the Jardins des Plantes; M. Decaise, president of the Academy of Sciences; M. Duméril, representative of the Imperial Acclimatization Society; and by the Maire of Montbard. Brussels has just erected and inaugurated a monument in honour of M. Verhaegen, the founder of the Free University in that city. M. Verhaegen died in 1862, having founded the Free University in 1834, and leaving, by will, to the municipality of Brussels the sum of forty thousand francs, for the encouragement of education.

Art Education in France.—Although architecture has so many professors and students in France, and although so much attention has been given of late to domestic architecture in particular, there has not existed a preparatory school for instruction in the practical parts of the art. The Academy and the New School of Fine Arts include architecture in their classes, and it holds a very eminent position in the course of studies, but the want of practical instruction has long been felt, and it is now being supplied. A central school of architecture has been set on foot, with the countenance of the government, under the patronage and with the subscriptious of the Prince Napoleon; M. Boitelle, Prefect of Police; MM. Michel Chevalier, Emile Péreire, E. Fould, Caffarelli, Viollet le Duc, Flachat, and other gentlemen. The school will be under the direction of M. Emile Trelat, Professor at the Conservatoire des Arts et Metiers, aided by MM. Tresca, Burat, Muller, de Mastang, and other professors. The studies will embrace all the elements of the art and science of architecture, and the course will occupy three years, when the pupils, it is hoped, will be better prepared than they are at present for availing themselves of the advantages of the School of Fine Arts, and more independent of the teaching of the workshop as regards knowledge of the materials employed in their profession and methods of construction.

Manufactures.

The Silk-worm.—The following account is taken from the report of Mr. Meadows, H.B.M. Consul at the port of Newchwang:—

"In a journey to the Corean borders during the autumn of 1863, I found myself, so soon as I had crossed the watershed of the Leaou mountains, travelling through a silk-producing country. I had, indeed, heard before of silk being produced at and near Fung-hwang city, but had considered it merely an amateur domestic occupation, not capable of being developed into a trade. That it is much more than this, and that it may furnish in time what the port greatly wants, an article of export to Europe, I have now no doubt. Questions have been raised as to the nature and characteristics of the silk-worm peculiar to this district, but only a personal visit to the silk-producing country for the express purpose of getting information could enable me to give answers to them on which I myself could place full reliance. It is difficult enough to extract good information from Chinese when in the midst of the things inquired of; at a distance it is next to impossible. As an instance of this, I may state that in spite of all my frequent inquiries, made both when in the silk-producing district and at this port from natives of that district, it is only within the last few months that I have learnt of another tree besides the oak on which the large worm feeds. The oak-bush is called locally *Po lih ko tsi*. The other bush is called *Chien tso tsi*. Its leaves are narrow and long, as compared with those of the oak-bush. Its bark is of a greenish white hue, and is smooth, and its trunk and branches straight and ungnarled as compared with those of the oak. It produces a seed or

fruit on which pigs feed. It must, I think, be a species of beech. The silk produced by worms fed exclusively on this bush are said to be stronger than when they are fed on the oak. It is, I fear, beyond doubt that the oak-leaf-eating worm, the *shan keen* or mountain worm, as the Chinese here call it, is of a different species from the mulberry-leaf-eater, which is here called the *kea keen* or domestic worm; and that, therefore, the hope of a beneficial crossing cannot be indulged in. On the other hand, the mulberry-leaf-eater or domestic worm of the Newcwhang consular district does seem to be of the same species as that of middle China; and it might be desirable to try the effects of a crossing with an animal that has probably for many generations been a separate inhabitant of this widely different climate. As the cocoon produced by the mountain worm is about three times the size of that produced by the domestic worm, so the worm itself is about thrice the thickness, though little if anything longer. It is of a brown or dry-earth colour, and has on its back little knobs or protuberances. In its flying stage the 'mountain' insect is a large and richly-coloured butterfly, measuring from tip to tip of its expanded wings some seven to nine inches, 'as large as a swallow.' A native of the silk country now here professes to have once fed a few mountain worms on mulberry leaves. They ate as much as five or six times the number of domestic worms, and the cocoons they spun did not at all differ in their appearance from those spun by mountain worms fed on oak-bushes. The same man tells me that the stuff made from the cocoon of the mountain worm will take only a black or a purple dye, and that those who desire to make with it a stuff of other colour are obliged to use some proportion of cotton threads. Looking to the three great classes of textiles, cotton, wool, and silk, the produce of the mountain worm must be classed with the latter, inasmuch as it neither grows on a shrub nor on an animal's back, but is produced by a leaf-eating worm, and, viewed as 'silk,' it is manifestly of an inferior quality. But if we choose to look at it simply as a new textile, there is some reason to believe that it may prove to have useful qualities not possessed by either silk, wool, or cotton. Should it be found to possess some such peculiar quality so useful as to make it specially marketable, then it will become a matter of interest to ascertain whether a cocoon-forming worm which exists in a wild state in British North America—near the Canadian lakes, I think—is not the same animal as the Newchwang 'mountain' worm. The climate of the two regions is essentially the same, and if the cultivation should seem desirable in Canada, the difficulty of want of experience as well as want of sufficient labourers might be got over by introducing Chinese emigrants from the Newchwang silk-districts. Be that as it may, the produce of the mountain worm spun into thread or as cocoons should, if the provincial authorities are not allowed to interpose barriers to foreign adventure, prove a fairly remunerative export from this port town, and that for the reason stated in the accompanying memorandum; it has for generations back paid Chinese dealers to send it seaward in junks.

Accidents from Steam Machinery.—In consequence of the removal of certain restrictions respecting the employment of steam power in manufacture, the *Moniteur* has collected and published an account of the accidents which happened through the use of steam during the past year. It appears that the accidents were only sixteen in number, but that the number of persons who were killed, or died afterwards of the injuries inflicted, amounted to forty, and that fifteen other persons were wounded more or less seriously. Of the sixteen accidents, four occurred in sugar works, three in paper manufactories, two each in distillery and drug works, and one each in other industries. The causes of accident are classified as follows:—Eight occurred by the explosion of cylindrical boilers; three by that of tubular boilers with interior furnaces; one by the explosion of a locomotive; and four by that of steam-heating apparatus. The immediate causes are supposed in eight cases to have been the bad quality of the metal employed or the vicious arrangement of the furnaces; in seven others, carelessness or want of superintendence on the part of engineers or stokers; and in the remaining case from the imprudence of other persons. The *Moniteur* gives the details in each case, in order that manufacturers may take warning for the future. This return of course does not include railway or other accidents which occurred in connection with, but were not immediately caused by, steam machinery.

Commerce.

Hops in France.—It appears from official returns that the cultivation of hops in France has increased considerably of late years. The hops planted in the department of the Bas Rhin in 1857 covered a superficies of 574 hectares (2½ acres each), and there have been 120 additional hectares planted within the last eight years. M. Heuzé, in a communication to the Imperial Agricultural Society, attributes this increase in the culture of hops to the improvement in agriculture. It must be observed, at the same time, that the quantity of hops imported is increasing every year. In 1845 there were only 721,000 kilogrammes imported, while in 1855 there were 1,556,000 kilogrammes. The landowners in the Bas Rhin are at present making every exertion to supply a sufficient quantity for home consumption, and to enable the country to be independent of foreigners for a supply. It is said that French brewers, for a great number of years, were accustomed to make beer without hops. They substituted for the hop plant coriander seed, wormwood, and the bark of box-wood, but the bad quality of the beer thus produced disgusted their customers, and they compelled brewers to use hops, as the only substance which can produce a wholesome beverage. It is stated that every inhabitant in France consumed, on an average, in the year 1825, nine quarts of beer. The consumption increased in the year 1837 to nearly twenty litres, and since then it has progressively increased.

The Tobacco Trade at New Orleans.—In 1863-4 the supplies of tobacco here were too trifling to establish a regular market, and there has been but little improvement since. The stock has varied from 594 hogsheads in September, 1864, to 1,031 in December last, and 873 recently. In comparing the year's business with 1863-4, it appears that the total supply has consisted of 3,004 hogsheads, embracing 594 hogsheads on hand at the commencement of the year and 2,410 received since, against a supply of 1,638 hogsheads last year. The exports have comprised 1,831 hogsheads against 797. The reported sales have been confined to 300 hogsheads against 514. Prices have exhibited a wide range.

Colonies.

Labour in the Victoria Gold Fields.—Since the commencement of the present year, the number of miners has gradually increased. In 1862, an average number of 97,942 miners was employed, producing an aggregate of 1,702,460 ounces of gold, equal to an average of £1 9s. 6d. weekly for each miner. In 1863, the miners numbered 92,292, producing 1,578,079 ounces, making the average weekly earnings £1 6s. 3d. each. In 1864, there were 83,394 miners, and the produce 1,557,397 ounces, equal to £1 8s. 9d. as the average earnings of each miner weekly. From January to the end of June, 1865, the number of miners was 85,022, who produced 656,436 ounces, making an average of £1 7s. 4d. each per week. In the first six months of last year, the numbers were 83,175 miners, resulting in 759,461 ounces of gold, or an average of £1 8s. 1d. per week for each miner.

The Vintage in Victoria.—The Victorian vintage is year by year becoming of more importance to the colony. There are flourishing and increasing settlements in the neighbourhood of Geelong, Castlemaine, and Sandhurst, as well as about Melbourne, devoted to the cultivation of the vine. Recently published statistics show that the total number of vines in the colony is now 8,150,000, of which 1,125,000 were planted in the preceding 12 months. The yield of wine from the vintage of 1865 will be short in quantity—in proportion to the increased area planted—but superior in quality. The deficiency is mainly attributable to the cold southerly gales and hailstorms that prevailed during the flowering season, by which every vineyard suffered severely. From the Yering and Tabilk districts the returns are most satisfactory; at the former, where 30 acres of vines are now in bearing, about 16,000 gallons of wine have been obtained, and at the latter place, where 150 acres are coming into bearing, the yield has been about 22,000 gallons. It is estimated that the total yield of the colony will not fall short of that of last year, which was 105,000 gallons of wine.

Agricultural and Pastoral Land in Victoria.—A return lately presented to the Legislative Council shows that in the year ending 31st March, 1864, the extent of land occupied by the squatters amounted to 31,683,366, or considerably more than half the area of the colony, whilst the average occupied by farmers was only 2,697,981 —an insignificant extent when compared with the area devoted to pastoral purposes. The number of persons employed in agricultural pursuits at the time of the last census was 41,218, of whom 6,480 were females, whilst the persons engaged in pastoral pursuits were only 9,724, of whom 644 were females. The same return shows that in 1863 4 the value of the pastoral produce was estimated at £3,316 793, whilst the value of the agricultural produce was estimated at £3,676,250.

Progress in Victoria.—A permanent Fine Art Gallery has been formed in Melbourne, and the promoters propose to keep the place open constantly for the exhibition (expressly for sale) of pictures by colonial artists. Government are about to expend £3,500 in the erection of a post-office, savings-bank, telegraph-office, and Mechanics' Institute for the Collingwood district. The Building Society movement is in great favour in this colony just now. Several new associations have been established lately, and with every prospect of success. An Acclimatisation Society has been formed in Gippsland, as a branch of the present Society in Melbourne.

Obituary.

Francois Joseph Heim, French historical painter, and member of the Academy of Fine Arts for nearly forty years. He was born at Belfort, in the year 1787, took the great prize of the Academy when twenty years of age, and obtained one of the grand medals of honour at the Universal Exhibition in Paris in 1855. He is represented in the Luxembourg gallery by a picture of the "Massacre of the Jews;" at the Louvre by two ceilings; and he executed several large works in Notre Dame and other churches of Paris. He produced a large number of works exhibiting great knowledge and power of composition, and a fine eye for colour; but he will be best remembered by his drawings, which are full of vigour and originality.

Admiral W. H. Smyth.—On Saturday, the 9th September, at his residence, St John's Lodge, near Aylesbury, passed away from us one whose name will ever be held in high honour in the annals of British science, and whose loss will be deeply felt by a large circle of attached and admiring friends. Although for several years past living in comparative retirement, yet devoted without ceasing, to within a few days of his death, to literary and scientific labours, Admiral William Smyth was at one time an active and prominent member of the scientific life of the metropolis. As president of the Astronomical Society, founder, and subsequently president, of the Geographical Society, vice-president, foreign secretary, and for many years member of the council of the Royal Society, director of the society of Antiquaries, visitor of Greenwich Observatory, one of the founders of the United Service Institution, in these and many similar capacities his untiring energy, extensive and varied acquirements, sterling integrity and honour, and his genial, social qualities exercised a great influence for good through the important circle in which he moved. He was born at Westminster, on the 21st of January, 1788, entered the navy at an early age, and served with considerable distinction in nearly all parts of the world, during the war which terminated in 1815. With a strong natural inclination for scientific pursuits, and an aptitude for work rarely equalled, he employed the following ten years in making those surveys of the less known parts of the bed and coasts of the Mediterranean which will ever associate his name with the history of that sea. Retiring in 1825 from marine life, he entered upon another phase in his scientific career, and commenced in his observatory at Bedford that laborious and accurate series of astronomical observations which resulted in the publication of the "Cycle of Celestial Objects," including the "Bedford Catalogue," a work universally acknowledged as one of the best handbooks of practical astronomy extant. Besides hydrography and astronomy, the admiral was an ardent cultivator of some branches of archæology, more especially numismatics; but a list of some of the more important of his numerous works will best give an idea of the extent and variety of his researches—"A Descriptive Memoir of the Island of Sicily," 1824; "Sketch of the Present State of the Island of Sardinia," 1828; "Descriptive Catalogue of a Cabinet of Roman Imperial large Brass Medals," 1834; "A Cycle of Celestial Objects," 2 vols., 1844; "Ædes Hartwellianæ, or Notices of the Manor and Mansion of Hartwell," 1851; "The Meditterranean, a Memoir, Physical, Historical, and Nautical," 1854; "Descriptive Catalogue of a Cabinet of Roman Family Coins," 1856; "Speculum Hartwellianum," 1860; "Addenda to the Ædes Hartwellianæ," 1864; "Sidereal Chromatics," 1864. Admiral Smyth married at Messina, in 1815, the only daughter of Mr. T. Warrington, of Naples, a lady of great accomplishments, and who has been the constant and devoted companion of all his scientific labours.

Publications Issued.

Electrical Communication in Railway Trains. By Andrew G. Brae. (*Effingham Wilson*, Royal Exchange). —The writer takes into consideration the causes which have hitherto prevented the successful application of this principle, reviews various attempts made, gives a list of several patents which have been taken out for the purpose, and then describes an invention of his own for effecting the object.

A Dictionary of Chemistry. Edited by Henry A. Watts. B.A., F.C.S. (*Longman and Co.*, London).—Part XXXI. of this work is just published, containing articles on Phenol and Phenymalines.

Popular Science Review. Edited by Henry Lawson, M.D. (*Robert Hardwicke*).—The October number of this periodical, which is a quarterly miscellany of entertaining and instructive articles on scientific subjects, completes the 4th volume, which contains the following articles:—Atlantic Telegraphy, by Robert Hunt, F.R.S.; On Pure Water, by Edwin Lankester, M.D., F.R.S.; On the Nature and Diagnostic Value of Raphides and other Plant-Crystals, by George Gulliver, F.R.C.S., F.R.S., &c.; On Lake Basins, by Professor D. T. Ansted, M.A., F.R.S.; Epidemics, Past and Present—Their Origin and Distribution; On the Microscopic Anatomy of an Insect Larva—Corethra Plumicornis, by E. Ray Lankester; The Moon, by James Breen, F.R.A.S.; Photography and some of its Applications, by the Editor.

Notes.

Cheap Railway Trips in France.—Visitors to Paris this year have the opportunity of visiting other parts of France at very moderate rates. An excursion to Strasbourg, enabling visitors to pass three days in that interesting town, took place the other day, the charge being 25fr. by the second, and 20fr. by the third class carriages, there and back. Another excursion train carries visitors to Havre and back for 12fr. and 9fr. respectively.

Cotton and Linen Tissues.—The *Builder* states that Professor Boettger has discovered the means, by the aid of chemistry, of recognising the presence of cotton in linen fabrics. He takes a piece of the suspected cloth, about two inches by three-quarters of an inch, and, after having unravelled both weft and warp, plunges it in an alcoholic solution of aniline and fuchsine. The superfluous colouring matter is removed by washing the piece of cloth thus dyed several times in water. If, while it is still wet, it be placed in a saucer containing ammonia, the cotton fibres will immediately become discoloured, while those of linen will preserve a fine red colour.

Cholera Precautions.—The head physician of the Paris and Strasbourg Railway Company has posted special instructions in all the stations on that line as to the precautious to be adopted in cases of an attack of diarrhœa. The company has, moreover, distributed among their *employés* boxes containing the medicine required at the first appearance of cholera, so that travellers and *employés* may find such remedies close at hand as are frequently sufficient to arrest the progress of the disease.

Special Education in France.—The establishment of a normal school of technical instruction, projected by M. Duruy, the Minister of Public Instruction in France, and mentioned in the *Journal* of the 8th of September, has been decreed, and the necessary steps taken to carry the plan into effect. In his report to the Emperor, the minister says that it is not enough that the manufacturers of France are supplied by the Ecole Polytechnique and the Ecole Centrale des Arts et Manufactures with managers and artizans of ability; they require also a good supply of foremen, whose hands have been exercised by practice, and whose intellects are also in some measure cultivated by study. To supply this want is the object of the new institution. It is necessary, says M. Duruy, in order not to interfere with the manual portion of the artizans' education, that the system of technical instruction should be so flexible that it may be bent to fit the various circumstances of the locality and the wants of the population, whether agricultural or manufacturing. Any uniform programme would therefore be unfit for the purposes in view, and it has been determined to appoint a special council, whose duty it will be to introduce such improvements into the system of each great special school as they may deem necessary, in order to maintain a due proportion between the scholastic duties of the pupils and the other elements of their training, or, in other words, to take care that the student does not obliterate the apprentice. These councils will be under a superior council of improvement, which will, moreover, be entrusted with the surveillance of the new Normal School of Cluny. This superior council will take cognizance of all documents likely to affect the subject, whether furnished by professors of schools, inspectors, or by those entrusted with missions abroad, and will decide on the measures to be proposed for adoption, by the minister, to the Emperor or the Imperial Council of Public Instruction. The Minister of Public Instruction is appointed president of this new council, and M. Dumas, of the *Institut*, vice-president. As regards the new establishment at Cluny, the minister has visited the old abbey in which it is to be placed, and finding that the buildings are sufficiently extensive to accommodate two establishments, it has been determined to create a special college side by side with the special normal school, in order that the pupil teachers may have the opportunity of immediately putting into practice the lessons which they have received from the professors of the superior establishment. The Abbey of Cluny will therefore be at once a normal and common school for the theory and practice of special instruction.

New Method of Fertilizing Soil.—Two gentlemen, members of the Agricultural Academy attached to the University of Bonn, M. Nouenbruck and Dr. Hardstein, have conceived a new method of assisting the formation of humus, and which, it is said, has been put into successful practice at Annaberg, near Bonn. The method is the introduction of air beneath the surface of the soil; a system of pipes, like those used for drainage, but pierced full of small holes, are laid at depths of from three to six feet beneath the surface of the ground, is placed in connection with a furnace, which keeps up a continual draft through the pipes, and thus the subsoil becomes so impregnated with air, that when the connection with the atmosphere is closed, the fire continues to burn in consequence of the superabundant oxygen which is conveyed to it by the pipes.

Correspondence.

Suburban Railway Traffic.—Sir,—The tardiness of our suburban railways is fast becoming a public grievance, one great cause of it being the time consumed in taking up and setting down passengers at the frequent stations; if a more expeditious mode of doing this could be discovered, railways near the metropolis might yet fulfil the hopes that have been formed of them. I believe I have discovered this "more expeditious mode," which I will describe as briefly as possible. I may premise that specially-constructed carriages would be required, and the addition of sidings to the stations which have not got them already; but this is merely a financial question. The plan is to have a passage through all the carriages, so that the train would communicate from end to end, and at the rear to have a setting-down carriage, so that the passengers who may wish to get out at any particular station have only to seat themselves in the last carriage, which the guard uncouples, and stops by application of break power. Thus far my plan is simple enough, and not by any means original. The real difficulty, however, is the taking up passengers when the train is on the move, and this I propose should be done as follows:—A carriage similar to the one cast off by the train should be in waiting in a siding, with the passengers in it, and this carriage the passing train would hitch on and draw after itself. Here, however, are two practical difficulties; one is to make the passing train catch up the end of the rope belonging to the waiting carriage,—but this problem any mechanic would readily solve, so, instead of taking up space to describe my own contrivance, I will pass to the next difficulty, which is to get rid of, or diminish, the shock of starting to the passengers in the carriage. Of course, if this cannot be done, the whole plan falls to the ground; but I think it can be effected in this way: The rope by which the carriage is drawn to the train should be wound round a drum containing a strong spring, so by this means the strain would be gradually applied. The strength of the spring would have to be proportioned to the force requisite to move the carriage—I suppose about double—so that when the rope would be half drawn out the carriage would begin to move, the speed of course rapidly increasing until it nearly equalled that of the train. The action of the spring could then be suspended by means of a break applied to the drum, and the newly-attached carriage would then attain a speed equal to that of the train, although at a considerable distance from it. There are various ways in which the carriage might be made to catch up the train, either by checking the speed of the engine at this point, or by manual labour in the carriage, or by both. When the carriage is coupled to the train, the new passengers would go to the body of the train,

and those wishing to be set down at the next station would take their places in the rear carriage, which would then be cast off and another taken, and so on at every station. The practicability of this scheme would, I think, be determined by the answers to these two questions:—First, what is the maximum of speed at which the operation of hitching on would be possible? Secondly, what is the minimum of speed which would effect a saving of time considerable enough to make it worth while to adopt this plan? Now if the maximum in the one case equals or exceeds the minimum in the other, the scheme may be considered worthy of adoption. For my own part I can see no reason why the operation described should not be possible at a speed of from six to ten miles an hour—perhaps more; while, on the other hand, it appears to me that if it were possible at any speed—if only at two miles an hour, or even less, provided the train did not actually stop—the plan would be advantageous. I do not propose this system for general adoption, but only for a few miles out of London, where, in fact, the passenger-traffic on some lines, under the present plan, has almost grown unmanageable. Beyond that distance passengers could change into ordinary trains. With this slight sketch of my scheme, I leave it to the judgment of those of your readers who are conversant with the subject. For my own part I can only say that if it be impracticable, I should be glad to be convinced of this as quickly as possible.—I am, &c., James Rigby Smith.

Patents.

From Commissioners of Patents Journal, October 13th.

Grants of Provisional Protection.

Balls, &c., of malleable iron or steel—2444—J. Player.
Billiard marker—2402—N. B. Thoyts.
Blast furnaces, drawing off gases from—2507—J. and G. Addenbrooke, and P. A. Millward.
Bleaching, &c.—2501—W. Schofield and J. Smith.
Bobbin holders—2406—J. Goulding.
Boots and shoes—2410—H. Hibling.
Bracelets, &c.—2497—C. Giuliano.
Bricks, &c., manufacture of—2392—J. Gillespie.
Candlesticks—2513—A. Hill.
Carding engines, &c., cards used in—2432—W. Turner, S. Shore, and W. Halliwell.
Casks, &c., machinery for making—2426—J. Davidson.
Cement—2505—J. Duke.
Centrifugal pumps and fans—2489—A. Rigg.
Clasps or fastening—2525—F. Jenner.
Coffins—2459—J. Hargreaves.
Coffins—2495—S. Dunn.
Colouring matter, manufacture of—2424—A. Schultz.
Colouring matters, preparing—2335—J. Holliday.
Conductors for electro-telegraphic purposes—2416—W. Beggett.
Copper, &c., calcining—2350—T. and T. L. G. Bell.
Cotton press—1916—S. Boyd.
Drilling machines, tightening chucks for—2491—E. T. Hughes.
Drugs, &c., mixing or grinding—2290—T. C. Gibson.
Effluvium traps—2499—E. Cottam.
Engraving on metal—2388—R. A. Brooman.
Envelopes, fastening—2430—J. E. Tuchet.
Fire-arms and ordnance—2466—W. E. Newton.
Fire-arms, breech-loading—2452—A. Prince.
Fire-arms, breech-loading, and cartridges for—2438—W. E. Newton.
Grain, machines for binding—2422—J. Sheldon.
Guns in ships, mounting and working—2306—J. Walker.
Hay, &c., presses for—2454—A. V. Newton.
Heating, producing and combining gases for—2527—S. C. Salisbury.
Hoisting machines—2414—W. R. Lake.
Knickerbockers—2460—W. Ambler.
Liquids, &c., decomposing and superheating—2535—R. A. Brooman.
Locomotive engines, &c., arresting the motion of—1736—P. D. Finnigan.
Magnetic telegraphs—2356—W. Clark.
Metallic surfaces, coating—2480—J. Boffey and C. W. Smith.
Metal plates to beams, &c., fastening—2384—R. Fox.
Needles—2074—C. O. Crosby.
Paddle-wheel propellers—2374—A. J. Sedley.
Paddles and oars, feathering—2434—W. J. M. Rankine.
Paper—2472—G. Eveleigh.
Paper bags and envelopes—2420—H. Rankin.
Paraffine, lamps for burning—2545—L. Hewitt.
Perfumes, &c., apparatus for distributing—2340—J. Dunbar and J. W. Butler.
Petroleum, &c., lamps for burning—2487—J. Maublanc.
Pipes, preventing leakages in—2503—C. F. Cotterill.
Planing wood, &c., bench stops for—2539—J. Heydon.
Portfolios and paper files—2468—G. T. Bousfield.
Presses, steam and hydraulic—2447—W. Routledge & F. F. Ommanney.
Punkahs—2148—J. E. Marsh.
Purses, &c., fastening for—2347—D. and J. Hyam.
Railway carriage doors, locking and unlocking—2442—J. H. Simpson.
Railway carriages, retarding the velocity of—1710—H. Shaw.
Railways and wheels for railways—2408—A. V. Newton.
Railways, permanent way of—2256—W. Clark.
Railways, signalling on—2474—A. Moore.
Rivets, &c., machinery for making—2353—J. Lewis.
Saddles and harness—2366—W. Clark.
Safes, &c.—2294—J. M. Hart.
Saltpetre, artificial—2142—I. Bernhard.
Scarfs, cravats, and ties—2046—W. and G. Crosher.
Screw wrenches—2396—H. A. Dufrené.
Securing tubes in tube plates, tools for—2455—R. T. N. Howey.
Sewers, &c., apparatus for ascertaining state of—2446—R. W. Barnes.
Sewing machines—2431—E. T. Hughes.
Sick rooms, lighting and heating—2515—J. H. Johnson.
Socks for boots and shoes—2428—C. and T. White.
Springs—2462—W. H. Brown.
Steam engines and valves—2286—W. Clark.
Textile and other substances, liquid composition for cleansing, &c.—2440—G. E. and E. L. Rolland.
Turning grate, fire-place—2298—A. Duvernois.
Vehicles, communicating between occupiers and drivers of—2400—E. Petito.
Washing and wringing machines—2478—R. A. Brooman.
Washing, &c., machinery for—2450—G. F. Smeeton.
Watches—2330—D. Keys.
Weaving, looms for—2543—J. Wadsworth, T. Hall, and S. Bonser.
Weft winding machines—2519—W. Longbottom.
Wool, &c., combing—1664—J. Busfield and S. B. Walmsley.
Wool, &c., machinery for carding—2533—C. Walker and W. Preston.
Wool, &c., preparing machinery for working—2517—W. E. Newton.

Inventions with Complete Specifications Filed.

Skins for tanning and currying, preparing—2585—H. A. Bonneville.

Patents Sealed.

1062. R. A. Brooman.	1158. J. T. Bucknill.
1066. J. M. Courtauld.	1160. W. Oxley.
1068. W. Clark.	1161. W. Clark.
1071. A. Henry.	1177. J. Carr.
1072. T. Newbigging & A. Hindle.	1204. F. Gregory.
1074. L. de St. Céran.	1272. J. H. Johnson.
1076. J. Dougan.	1286. J. H. Johnson.
1079. F. C. Bakewell.	1301. W. J. Rice.
1081. J. J. Jenkins.	1372. T. Molden, J. Newsome, and J. Akeroyd.
1083. W. Bedder.	1626. H. A. Bonneville.
1088. R. A. Jones and J. Hedges.	1650. G. Clark.
1093. M. Vogl.	1748. W. R. Lake.
1096. H. K. Taylor.	1776. J. Jobson and J. F. Dickson.
1102. F. A. Abel.	1782. G. Carter.
1103. W. Hale.	1838. T. C. McKeen.
1105. W. Beaven.	1846. H. A. Bonneville.
1106. W. Robinson.	1953. R. B. Mitchell.
1129. C. J. and J. A. Keenan.	2203. H. A. Bonneville.
1137. H. A. Bonneville.	2204. H. A. Bonneville.
1144. W. Clark.	
1155. J. Wilkinson.	

From Commissioners of Patents Journal, October 17th.

Patents Sealed.

1087. R. A. Brooman.	1100. T. Hampton and J. Abbott.
1099. M. Houssepian.	

Patents on which the Stamp Duty of £50 has been Paid.

2735. J. Lowe and J. Harris.	2785. F. F. Prud'homme.
2744. R. A. Brooman.	2813. B. Lauth.
2756. C. Thomas.	2777. W. Wilson.
2762. F. G. Grice.	2789. E. A. Cowper.
2767. C. Harratt.	2789. H. Ransford.
2749. A. V. Newton.	2836. G. T. Bousfield.

Patents on which the Stamp Duty of £100 has been paid.

2270. L. Wray.	2307. G. F. Wilson.
2258. J. Saxby.	2344. T. Twells.
2259. J. Beattie.	2284. J. and J. Braby.
2274. G. Beadon.	2291. T. Ingram.

Registered Designs.

A Table Cloth or Cover—October 2—4745—Anna Pope, 4, Bulstrode-street, W.
Writing Cabinet—October 2—4746—W. Mitchell, 76, Cannon-street, City, E.C.
Cistern Ball—October 6—4747—W. E. Tilley, 6, Kirby-street, Hatton-garden, E.C.
Improved Stay Busk—October 13—4748—J. Ellis, jun., Bristol.
A Self-fastening Grid or Cover—October 16—4749—G. Shorland and J. Bushell, Manchester.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, OCTOBER 27, 1865. [No. 675. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Institutions.

The following Institution has been received into Union since the last announcement:—

Gomersal (near Leeds), Mechanics' Institution.

Notice to Members.

The One-Hundred-and-Twelfth Session of the Society will commence on Wednesday, the 15th November, when the Opening Address will be delivered by Wm. Hawes, Esq., F.G.S., Chairman of the Council.

The following are the dates of the Wednesday evening meetings, the chair being taken at Eight o'clock:—

1865.	November	—	—	15	22	29
„	December	6	13	20	—	
1866.	January	—	—	17	24	31
„	February	7	14	21	28	
„	March	7	14	21	—	
„	April	4	11	18	25	
„	May	2	9	16	23	30
„	June	—	—	—	27*	

For the Meetings previous to Christmas, the following arrangements have been made:—

November 15.—*Chairman's Opening Address.*

November 22.—"On Water Supply, especially in Rural Parishes and Districts." By J. Bailey Denton, Esq.

November 29.—"On the Proposed Purchase of Railways by the Government." By William Hawes, Esq., F.G.S.

December 6.—"On London Milk." By J. Chalmers Morton, Esq.

December 13.—"On the Graphotype, a Process for producing from Drawings, Blocks for Surface Printing." By Henry Fitz-Cook, Esq.

December 20.—"On Parkesine, its Composition, Manufacture, and Uses. By Owen Rowland, Esq.

The Cantor Lectures for the ensuing Session will consist of Three Courses, to be delivered by G. W. Hastings, Esq., LL.D., Barrister-at-law; Fleeming Jenkin, Esq., F.R.S.; and Dr. F. Crace Calvert, F.R.S.

The following are the particulars of Mr. Hastings's course:—

Lecture I. — Monday, November 27th. — "The Effects of the Discovery of the Precious Metals on the Ancient Civilisation of the Mediterranean."

Lecture II. — Monday, December 4th. — "The Effects of the Discovery of the Precious Metals on Modern Civilisation.

Lecture III. — Monday, December 11th. — "On Copyright."

Lecture IV. — Monday, December 18th. — "On Limited Liability."

The chair will be taken each evening at Eight o'clock.

These Lectures are open to Members, each of whom has the privilege of introducing one Friend to each Lecture.

* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

Proceedings of the Society.

CANTOR LECTURES.

"On some of the most important Chemical Discoveries made within the last Two Years." By Dr. F. Crace Calvert, F.R.S., F.C.S.

Lecture IV.

Delivered on Tuesday, the 25th of April, 1865.

On some of the Discoveries in Agricultural Chemistry.

I shall in this lecture follow the same plan as I observed in my last (No. 3), taking a general view of the subject under consideration, and introducing as I proceed some of the most important discoveries which have been published of late on each particular subject. By adopting this plan I shall, on the one hand, avoid publishing a mere review of the results obtained, and on the other, I shall be enabled to give a general outline of the views entertained by most chemists of the present day on the subject of Agricultural Chemistry. You will also be better prepared to appreciate the value of the important discoveries made by our own countrymen, who, I am happy to say, are not sur-

passed in that branch of applied chemistry by any other class of chemists existing on the Continent.

The largest number of organic substances are composed of only three elements or simple bodies, viz., carbon, hydrogen, and oxygen, and even in many the latter substance is absent—for example, in many essential oils and the products resulting from the destructive distillation of organic substances, whilst those which contain oxygen are chiefly represented by starches, gums, resins, organic acids, and fixed oils; another class, such as morphine, quinine, and indigo, contain nitrogen, in addition to the substances mentioned. There is another class of substances, limited in number, which contain sulphur and phosphorus besides the four elements above cited; these are represented by albumen, corresponding to the white of an egg, or the serum of blood in animals; fibrine, represented in animals by the clot of blood; caseine, characterised in animals by the curd of milk. Therefore the whole of the organic matter of the vegetable kingdom is represented by the uniting together in various portions (influenced by particular molecular arrangements) of six elements, viz., carbon, hydrogen, oxygen, nitrogen, sulphur, and phosphorus.

Although organic matters are composed of two or more of these elementary substances, they are never found in vegetable matters in their pure and isolated condition. They are always combined with a certain quantity of mineral matters which appear essential to the healthy condition of plants, and are, so far as we know, essential to the formation of the organic bodies themselves. Thus chemists have ascertained that plants generally contain lime, potash, soda, magnesia, oxide of iron, sulphuric acid, phosphoric acid, &c.

Let us examine the principal sources from which plants derive the elements essential to their formation, growth, or healthy progress. The most important element of all vegetable substances, and which, in fact, characterises all organic matter, is carbon, or what is commonly called charcoal. This element is derived entirely in vegetables from a colourless, invisible, and slightly acid gas, having a specific gravity of 1·52, and also sparingly soluble in water—I mean carbonic acid. You will easily conceive, on reflection, what an enormous proportion of carbonic acid must be produced annually, when you consider the vast amount of vegetation which surrounds us, produced either by the hand of man, under the influence of the plough, and other instruments, or by the rapid growth of trees and other vegetation which covers our hills and mountains. In truth the Divine Being has provided for an abundant supply, for there exist many sources of production of this gas so necessary to vegetation. It is useless to record here the well-known modes of producing this gas by respiration and combustion, but I wish to call your attention to some more special sources of its production with which you may not be so perfectly acquainted. M. F. Kulhmann, a well-known chemist, published in 1861 and 1862 a most interesting series of papers on the production of carbonic acid through the oxidation and reduction of the oxides of iron by their contact with organic matter. Thus he found that, if he took a clod of earth, the bulk of the iron existing on its surface was in a state of peroxide, mixed with a small quantity of protoxide, whilst towards the interior of the soil the reverse was observed. M. Kulhmann thus found that the oxygen of the oxide of iron was conveyed to the organic matter to convert it into carbonic acid. He further made the remark that sulphate of lime was, as M. Chevreul had already observed, a powerful oxidising agent, or served as a conveyor of the oxygen of the atmosphere to the organic matter existing in soils, the sulphate of lime becoming converted into sulphuret of calcium. These results explain certain facts observed by two learned chemists, MM. Boussingault and Loewig, who found that there existed large quantities of carbonic acid in cultivated soils, and especially in those that were highly manured, and that the production of this gas was continuous and most abundant. The following table, taken from their researches' will satisfy you, I hope, of the correctness of the above assertion:—

Carbonic Acid.

Air	0·4
Recently manured soil	54·6
" " "	235·3
Vineyard	282·4
Forest loam	70·6
Forest land	88·2
Soil rich in manure	420·6
Meadow	161·8

Another source of the production of carbonic acid gas is one lately pointed out by a gentleman whom I cited last year with great, but not exaggerated praise, as a successful demonstrator of the untruth of the theory of spontaneous generation. M. Pasteur has demonstrated that wherever there is decay there is life—that, in fact, the rapid decay of organic matter depends in a great measure on the existence and maintenance of microscopic beings, and, as I stated in my last year's lecture, death is life. For M. Pasteur has shown that in all decaying matter exposed to the atmosphere, there exist mycoderms which carry the oxygen of the atmosphere to the organic matter, converting its carbon into carbonic acid, its hydrogen into water, its sulphur into sulphuric acid, its phosphorus into phosphoric acid. As to its nitrogen, other chemical actions come into play. There is still another source of production of carbonic acid, which I cannot pass by in silence, for though at the present day its activity is decreased by the better cultivation of land, its influence must have been very great when men were less numerous on the surface of our planet, and no doubt, even now, that source of production of carbonic acid plays a great part in the vegetation of wild forests such as those of Northern and Southern America. Dr. Lyon Playfair, Mr. J. A. Ransome, and M. Morin, proved some years since that certain small vegetable substances, known under the names of confervæ and algæ, had the property, under the influence of light, of decomposing carbonic acid; while, on the contrary, in diffused light or darkness they yield carbonic acid. Strange it is to think that often some of the trees of these wild forests carry on their surface or their bark the vegetables which are to destroy them by absorbing their sap, and to feed them by liberating the carbonic acid essential to their growth. As to the confervæ, which exist in marshy lands, pools, and other stagnant waters, they disappear by the hand of man as he drains the land and improves it for agricultural purposes. Notwithstanding the abundant sources of the production of carbonic acid, the atmosphere appears to contain but a minute quantity, viz., four parts in 10,000. This fact may be regarded as owing, first, to a law discovered by Dalton of the extraordinary property which gases have of being diffused and mingling together; secondly, to the immensity of the atmosphere as compared even with the abundant sources of carbonic acid; thirdly, to its removal by constant vegetation, either on land or in the ocean; fourthly, that a great portion of the carbonic acid which is produced in the interior of soils is absorbed by the spongelets of plants. Liebig calculated, some years since, that if our sources of production of carbonic acid were to cease, and the present state of vegetation on the surface of our planet still continued, there was a sufficient amount of carbonic acid in the atmosphere to maintain it in full activity for a great number of years. As to the decomposition of carbonic acid by the leaves of plants under the influence of the chemical rays of light—scientific points which have engaged the attention of many chemists, among whom I may cite Boussingault, Dr. Gladstone, Grinwenden, and others, it is unnecessary that I should do more than state that the carbon of the carbonic acid is retained by the plant and contributes to produce the organic matters which form the frame of it, whilst the oxygen is liberated in a pure state to contribute again to the reproduction of

carbonic acid by fixing itself on the carbon of decaying matter, or that which is produced by combustion or animal respiration.

Nitrogen.—The absorption and fixation of nitrogen in plants are of the highest importance to vegetation, and no subject has more engaged the attention of chemists and agriculturists than the ascertaining how nitrogen was supplied to plants, for if the quantity of nitrogen is found but in small quantities in plants, still its supply to vegetation is essential to the growth and health of those plants. The quantity of nitrogen that a plant requires is but small, but still as it is an essential element to the formation of nitrogenated substances, and as these are always found most abundant in all newly-formed vegetable matters, such as the germ from the seed or the sprout of the plant, nitrogen must be freely supplied by the agriculturist if he wishes to obtain an abundant crop.

Liebig's publications of 1841, proving the identity of the nitrogenated substances of plants, such as albumen, fibrine, caseine (legumine), with those existing in animals, and the exaggerated views entertained by Boussingault and Payen on the value of manures in accordance with the quantity of nitrogen they contain, led many chemists to investigate whether the nitrogen which plants require for the production of these nitrogenated substances was derived either from the atmosphere in its gaseous form, or from ammonia or nitric acid existing also in the atmosphere or in the soils in which the plants grew. An animated discussion, based upon a long series of researches, ensued between Boussingault and Ville, the latter contending that plants could absorb nitrogen from the atmosphere and fix it as a part of their organism; the former contending that the nitrogen contained in plants was derived either from ammonia or nitric acid. This discussion was still proceeding when Mr. Lawes and Drs. Gilbert and Pugh published, in the "Memoirs of the Chemical Society of London," 1863, such a complete and elaborate series of researches that chemists came to the conclusion that the nitrogen existing in plants was not derived from the atmosphere as nitrogen. There can be no doubt that the general tendency of scientific as well as practical investigation, as above stated, proves that it is most probably under the form of nitric acid, or more so in a state of nitrates, that nitrogen penetrates into plants, and becomes one of the essential elements of the formation of albumen, fibrine, legumine, or other nitrogenated substances which are found existing in vegetables. We shall as we proceed go more deeply into these interesting data, connected not only in a scientific point of view with agriculture, but having a most important bearing on its practical progress; and to give you here only one example of the importance of the subject under consideration, I may be allowed to cite the thousands of tons of guano, which have been imported into this country with a view of supplying to plants the nitrogen they require for active vegetation. In fact, so much importance was attached some twenty years ago to the presence, and more so to the amount, of nitrogen in a manure, that the whole of its commercial value was based upon the real amount of nitrogen it contained; and although in the present day these views have been greatly modified by the publications of Liebig, which have shown that for the healthy growth of plants certain mineral matters are essential, and if not so essential as nitrogen, are as important, still the commercial value of a manure at the present day depends, in a great measure, on the amount of nitrogenated matter which it contains; and there can be no doubt that the ardent discussions which have taken place between the chemists who were in favour of attributing the whole of the value of a manure to nitrogen, and Liebig, who denied these views, and supported, with his usual indomitable spirit, his all-exclusive mineral theory, led to the conclusion that if plants can live without the addition of manures, still that the use of them stimulates vegetation in a marked degree.

These views of Liebig were based on the fact that after he had noticed trees growing on a barren rock, he asked, whence did these trees derive the elements necessary to the formation of the organic tissues which entered into their composition. The reply was obvious—from the atmosphere. Therefore, if we give to plants the mineral elements, they can derive their organic construction from the elements existing in the atmosphere, and to substantiate those views, he discovered in rain water, collected in the open country, away from all sources of pollution, nitrate of ammonia, results which were confirmed by Dr. Lyon Playfair, and by the researches of Barrall, which are shown in the following table:—

Rain Water.—Paris.

Nitrogen	7·939
Ammonia	2·769
Nitric acid	21·800
Chlorine	1·946
Lime	5·397
Magnesia	2·300

No doubt the views of Liebig are correct in theory, and will suffice for a slow and feeble vegetation, but will not answer the requirements of active husbandry, especially with heavy rents, and this has been demonstrated beyond all doubt by the elaborate researches pursued for years and at a great expense, by Mr. Lawes and Dr. Gilbert, who proved that if, on the one hand, an addition of a certain proportion of nitrogen is essential to vegetation, on the other a due regard must be paid to the nature and the amount of the mineral matters supplied to crops according to their peculiar requirements, as shown by the following tables:—

Quantity of Wheat on same Land 12 to 20 Years.

	Bushels per Acre.
Farmyard manure	35
Unmanured	15
Super phosphate of lime	18
Salts of ammonia	22
Salts of ammonia Mixed mineral manure	38
Nitrate of soda	25
Nitrate of soda Mixed mineral manure	34

Table showing the Effect of Ammonia Salts and Mixed Mineral Manure.

Dressed Corn per Acre in Bushels and Pecks.

Plot.	1852.		1853.		1855.		1856.		1857.		1858.		1859.		1860.		1861.		1862.		1863.		1864.		Annual Average.				
	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.	B.	P.			
3	13	3	5	3	21	0	17	0	14	2	19	3	18	0	18	1	12	3	11	1	16	0	17	1	15	2	...		Unmanured.
5	16	3	10	0	24	0	18	1	19	2	23	3	19	0	20	2	13	3	15	1	17	3	19	2	18	1	2	3	Mineral Manure.
17	24	3	8	2	44	0	18	0	31	0	26	1	33	2	20	2	25	1	18	2	27	3	21	1	18	3	3	1	Mineral Manure
18	14	1	19	1	23	3	33	0	16	3	40	2	21	3	32	2	15	3	32	3	18	2	46	1	32	2	17	0	& Ammonia Salts
10 A	21	3	9	3	34	1	19	3	24	0	29	0	22	3	18	3	15	0	12	3	23	0	39	0	22	2	7	0	Ammonia Salts
10 B	22	0	15	2	39	0	28	0	27	2	34	2	27	3	25	2	18	2	15	3	24	3	43	2	26	3	11	1	alone.
7	26	3	23	2	45	1	33	0	36	3	44	3	39	0	34	2	27	2	34	3	35	3	53	2	36	1	20	3	Ammonia Salts & Mineral Manure.

From these practical results, and many others which will be fonnd in the papers published by Mr. Lawes, F.R.S., and Dr. Gilbert, F.R.S, in the *Journal of the Agricultural Society of England*, 1863-4, it is evident that in this case, as in many others I could cite, extreme views always bring a medium result which time generally confirms as the correct one.

I shall have to refer more minutely to these theories as I proceed with my lecture. Let me, meanwhile, call your attention to several chemical reactions which tend to modify organic matter, and render it fit to penetrate into plants, so as to enable them to yield the nitrogen so essential to vegetation. If the conversion of nitrogen into nitric acid, under the influence of certain mineral substances, has been known by its results for a long period in what is called the nitrification in the walls of our dwellings, still the demonstration of the conversion of ammonia into nitric acid is the result of comparatively recent researches. Even at the present day on the Continent it is believed (except by scientific men) that the moon has a great influence on the production of nitre in the walls of dwellings. Now, it is not the moon which has that power, but the sun, and as both move in the same direction the influence of one must be affected by the other, for as we know from the researches of Bunsen and others, as stated in my first lecture, that the intensity of chemical rays is in ratio with the intensity of light, it follows that it is the chemical rays of the sun which affect the conversion, and not the rays of the moon. At all events it is easy to conceive how ammonia can be converted into nitric acid in the walls of our dwellings, for sulphate of lime has the power of condensing ammonia, and no doubt, as demonstrated by Kulhmann, of yielding its oxygen, thus converting its hydrogen into water, and its nitrogen into nitric acid, which in its turn destroys the sulphuret of calcium, giving birth to nitrate of lime. We all know that formerly, not only the rubbish from our dwellings was used as a means of obtaining the nitre which was required to manufacture the gunpowder used at that period, but that artificial nitre beds were prepared so as to yield the nitrate of potash required for war purposes. Even until recently, in Switzerland and Norway, the peasantry were subjected to a tax of supplying the government every year with a certain weight of nitre which those governments required for the preparation of gunpowder. Many researches have been undertaken to try and throw light on the chemical changes which take place in the conversion of the nitrogenated organic matter existing in such bodies into nitrates. The most interesting series of researches published on this subject are those due to M. Millon, which you will find in the *Comptes Rendue de l'Academie de Sciences*, 1864, in which he has shown that the production of nitre is in ratio with the quantity of vegetable matter, especially humic acid, that a soil contains, and that the most favourable land for the production of nitre is that which is called mould by gardeners. He further ascertained that if he made a mixture composed of ordinary earth, 20 parts, ashes, 4, mould, 3, the production of nitre was most active, and also that the oxygen of the air had a great influence on its production, converting the ammonia resulting from the decay of the organic matter into nitric acid.

These facts are well illustrated in the following table quoted from his researches:—

NITRIFICATION.

		Parts.
Soil	Earth	20
	Ashes	4
	Decayed manure	3

	Quantity of Nitre.
Upper Layer	440
Middle do.	441
Bottom do.	009

From the above you will gather that in the upper part of a bed (1 metre in depth, and composed as above shown) there is far more nitre than in the lower portions of it. These researches of M. Millon threw much light on those published some years since by M. Boussingault, who ascertained the rate of proportions of nitre that existed in various qualities of soils and also the influence of manured land on the production of nitre in soils. Thus, M. Boussingault found that the quantity of nitre in non-manured land was a mere trace; in uncultivated land there were from 1 to 0·5 in 1,000 parts of soil, whilst in cultivated land, and in highly manured ground, 18 parts in 1,000. He further observed that if he manured a piece of land, after 7 days there were 12 parts of nitre per 1,000; in 17 days, 81 parts; in 15 days more 233; in 15 days more 280; and in 15 days further 260; and then the quantity decreased rapidly. M. Millon has clearly demonsrated that the substance which first absorbs, and then helps the conversion of the ammonia into nitric acid, is the one known by chemists under the name of humine or humic acid. The presence of a small quantity of nitrates and traces of nitre in uncultivated land may be due to two different sources.

First, Liebig, as we have already stated, demonstrated some years since, and his results have been confirmed by other chemists, that there always exist in the atmosphere small quantities of nitric acid, which are brought down to the soil by rain-falls.

Secondly, M. Cloez has recently demonstrated that the mere passage of purified air over porous substances is sufficient to force a small amount of air and oxygen to combine together so as to produce a small quantity of nitric acid. Further, all soils, so far as we are aware, contain organic matter, with which the soil comes into contact from time to time. The tenacity with which soils retain organic matter is very remarkable, for Uraldini has lately proved that if you treat a soil several times with strong muriatic acid, and wash the residue with water so as to remove all traces of acid, still, in that residue you will find the presence of organic matter. The following researches prove that the nature of this organic matter may be either considered as being similar to humine, as shown by M. Millon, or similar to cellulose, as shown by Verdeuil, or of a nitrogenated nature, as demonstrated by Baron Paul Thenard. The elaborate researches of this gentleman are most interesting in many points of view, and, without entering into details, allow me to state that he has extracted from decayed dung, as well as from soils, an acid which he has called fumic acid. This nitrogenated acid is insoluble in water, but freely soluble in weak ammoniacal liquors, thus facilitatiug its absorption by soils when rotten dung is laid on land as a manure. But this solubility of the fumate of ammonia soon disappears, for immediately that fumic acid comes in contact with peroxide of iron or oxide of aluminium (alumina) it forms an insoluble compound, which presents great stability, explaining at once how land manured one year can retain with tenacity the essential nitrogenated elements of the manure which it had one, two, or three years previously. What enhances the value of these recent researches is that Baron Thenard has succeeded in producing artificially the acid which he has discovered in rotten dung, and that by simply heating starch, sugar, gum, or substances existing in straw and other vegetable matters, with ammoniacal salts or nitrates, it being employed by him as a substitute for what we may conceive takes place under the slow action employed by nature to accomplish her general purposes. If Baron Liebig's views respecting the importance of adding mineral matters to exhausted soils were too exclusive, as tending to establish that it was necessary to use other vegetable and animal manures for a farmer to produce remunerative crops, still, there cannot be a doubt that he has rendered great service to the progress of agricultural chemistry by drawing the attention of scientific men to the general composition of soils, and enabling them to point out the

essential mineral substances that a soil should contain for it to claim the title of being fertile.

The most complete and elaborate researches which we possess on this intricate subject are due to one of our leading agricultural chemists, Dr. A. Voelcker, who has published in this year's *Journal of the Royal Agricultural Society of England* (p. 128), of which society he is the appointed chemist, a paper on some of the causes of the unproductiveness in soils, and the following table will give you not only an idea of the extent of his labours, but also point out the difference there is in the composition of soils, and that if in a soil there exists a great excess of one substance, as compared with others that compose it, that soil becomes unproductive:—

Composition of Unproductive Peat Land, Clay, Calcareous, and Sandy Soil.

	Calcareous soil.	Sandy soil.	Clay soil.	Peaty soil.
Moisture	...	2·65	...	...
Organic matter and water	...	4·56	7·94	49·07
Oxides of iron and alumina	·780	5·93	10·95	10·88
Carbonate of lime	73·807	·39	·86	2·29
Magnesia	·825	...	·26	·75
Potash and soda	traces	·28	·39	·90
Phosphoric acid	·242	...	·10	·06
Sulphuric acid	1·546	...	·30	1·04
Silica	16·710	86·19	...	...
Insoluble silicious matter	6·090	...	79·20	35·01
	100·000	100·00	100·00	100·00

Dr. Voelcker summed up his researches on the unproductiveness of soils in the following words:—

"Having spoken at some length of a variety of conditions which appear to me to affect the fertility of the land, my subject perhaps may be usefully brought to a close by a brief statement of what, in my opinion, the chemical analysis of soils can determine, and what it necessarily must leave undecided.

"In the first place I would remark, that the chemical analysis of soils can give very decided answers to the following questions:—

"1. Whether or not barrenness is caused by the presence of an injurious substance, such as sulphate of iron or sulphide of iron?

"2. Whether soils contain common salt, nitrates, or other soluble salts, that are useful when highly diluted, but injurious when they occur too abundantly?

"3. Whether or not barrenness is caused by the preponderance of—Organic matter, or lime, or sand, or pure clay?

"4. Whether sterility is caused by the absence or deficiency of—

"*a.* Lime.

"*b.* Phosphoric acid.

"*c.* Alkalies, especially potash.

"*d.* Or available mineral (ash-constituents) matters generally.

"5. Whether clays are fertile or barren?

"6. Whether or not clays are usefully burnt and used in that state as manure?

"7. Whether or not land will be improved by liming?

"8. Whether it is better to apply lime or marl or clay on a particular soil?

"9. Whether special manures, such as superphosphate or ammoniacal salts, can be used (of course discreetly) without permanently injuring the land, or whether the farmer should rather depend upon the liberal application of farm-yard-manure that he may restore to the land all the elements of fertility removed in the crops?

"10. What kinds of artificial manures are best suited to soils of various compositions?

"11. Whether deep-ploughing or steam-cultivation is likely to be useful as a means of developing the natural stores of plant-food in the soil?

"12. Whether the food of plants in the soil exists in an available or inert condition?"

(*To be continued.*)

Proceedings of Institutions.

Marlborough Reading and Mutual Improvement Society.—The twenty-first annual report, presented at Michaelmas last, states that, although neither the number of members nor the income of the society has quite reached that of the preceding year, the balance in the treasurer's hands is about £2 more than at the corresponding period of last year. The committee having felt it their duty to limit the number of their lectures for the approaching season, have yet been enabled to make such engagements as cannot, they think, fail to meet with the approval of the members; they have also, after much consideration, determined not to issue season tickets, as it is believed ladies, not members of the society, who may wish to attend any of the lectures will not hesitate to take the ordinary tickets of admission. Owing to the prospect of a less sum being required for lecture purposes this year, the committee think it would be desirable to expend the sum, which it is hoped will thus be available, in a further increase of the society's library. The receipts have amounted to £169 3s. 9d., and there is a balance in hand of £26 7s. 3d.

South-Eastern Railway Mechanics' Institution.—The report for the half-year ending 30th September last (being the thirty-sixth report), says that the present position of the Institution is highly satisfactory. There is always a diminution in the attractions of institutions of this kind during the summer months, but on this occasion, however, the falling off has not been so great as formerly. The present number of members is 215, being an increase of 30 over the corresponding period of last year. Three volumes have been added to the library during the half-year. The books have all been carefully examined, and a great number of them have been substantially rebound. The library now contains 1,403 volumes in excellent condition. Upwards of 1,000 volumes have been in circulation during the half-year; and the issues show that works of an intellectual and instructive character are occupying the attention of the members more than formerly. Two of the members were successful in the examinations of the Society of Arts, in May last, William Griffiths obtaining a first-class certificate in arithmetic, and Richard Giles a second-class certificate in the same subject. The former has, therefore, become entitled to 12s. worth of books from the Institution, and the latter to 8s. 6d. worth of books. The council would be very pleased if the members would more extensively avail themselves of these examinations. Arrangements have again been made to enable the members of this Institution to attend the whole course of lectures in connexion with the Ashford Institution, free of charge. The vocal music class was carried on successfully for the first three months of this half-year. The council recommend the formation of classes for the winter months, in arithmetic, French, mechanical drawing, vocal music, grammar, and composition; and they hope to make satisfactory arrangements for carrying them into effect. The council would also be very pleased to see the chess club revived amongst the members. The accounts show that the financial position is exceedingly gratifying. The sum of £67 11s. 9d. was realised by the excursions to Boulogne and Dover, on the 1st of September, which were so liberally granted by the directors of the South-Eastern Railway Company, in aid of the funds of the Institution. The balance-sheet shows that the receipts amounted to £129 15s. 5d., and that there is a balance in hand of £84 9s. 9d.

EXAMINATION PAPERS, 1865.

(*Concluded from page* 729.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April, 1865:—

GEOMETRICAL DRAWING.

THREE HOURS ALLOWED.

The constructions must be accurate, and show clearly, by plain and dotted lines, with appropriate letters of reference, the principles on which they are based. They may be put in ink or left in pencil, at the discretion of the candidate, provided they are distinct.

No deviation from the conditions of the questions can be admitted; and since no candidate must answer more than one question from any one section, he is advised not to attempt more than the time will admit of his completing, since little or no credit will be given for incomplete or inaccurate answers.

I.

Divide a line 3·75 inches long—

1. Into two segments, so that the rectangle contained by them may be 2 inches in *area*.
2. Into two segments, such that the squares described on them may be as 3 : 2.
3. Into three segments, such that the rectangle contained by the whole line and the less segment may be equal to that contained by the other two.

II.

Construct a triangle from one of the following conditions—

1. Its sides as 3 : 3·5 : 4 and their sum 8 inches.
2. Its sides in that ratio, and its area 4 inches.
3. Its base 2·5 inches, its sides equal, and the angles at the base double that at the vertex.

III.

1. The sides of a rectangle are 2 and 3 inches; construct an equilateral triangle equal to it in area.
2. Construct a regular pentagon of 2 inches side, and a regular hexagon equal to it in area.
3. Inscribe a square in a hexagon of 2 inches side.

IV.

1. Two indefinite lines contain an angle of 50°, draw a circle of 1 inch radius to touch both.
2. A point is 1 inch from the circumference of a circle of 2 inches radius, draw a line from the point to cut the circle so that the intercepted chord be 2 inches long.
3. Draw a chord in a circle of 2 inches radius, so that the angle in the greater segment cut off by it may be 70°.

V.

1. Draw the *plan* of an equilateral triangle of 2·5 inches side when its corners are 1, 1·5, and 2·5 inches above the paper.
2. A square of 2·5 inches side lies in a plane inclined to the paper at an angle of 35°, and one side of the square is inclined to the paper at 20°, show it by a *plan* and *elevation*.
3. Draw the plan of the same square when two of its sides are inclined at 20° and 40° to the paper.

VI.

1. Draw a plan and elevation of a cube of 2·5 inches sides when three of its corners are 1, 2, 2·5 inches above the paper.
2. Draw the same cube when the planes of two of its faces are inclined at 35° and 70° to the paper.
3. A right prism, 3 inches long, with a pentagon of 1·25 inches side for its base, is to be represented in *plan* and *elevation* when the line joining one corner and the centre of the opposite end is vertical.

VII.

1. A sphere of 1·6 inch radius lies on the paper; represent an indefinite plane inclined at 50° touching the surface.
2. Draw the plan of the circle in which a plane having the same inclination of 50° cuts the sphere at 1 inch from its centre.
3. A right cone and a right cylinder have the same circle of 1·5 inches radius for their common base, and a height of 4 inches; determine the sections of both, made by a plane inclined at 70° to their common axis, and passing through its middle point, the true forms of the sections to be given.

VIII.

A rectangular block 4·5 inches long, 3 inches wide, and 2·25 inches high, has a prism of the same length and breadth, and 1·5 inches high, resting on its upper face; represent this solid, either—

a. By a plan and elevation on a plane equally inclined to its two vertical faces.

b. By an isometrical projection.

c. By a perspective projection, the distance of the point of sight, &c., being at pleasure.

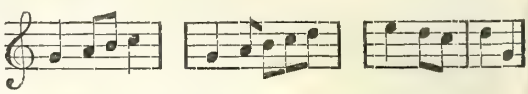
THEORY OF MUSIC.

THREE HOURS ALLOWED.

I. RUDIMENTS OF MUSICAL GRAMMAR.

(*Nos.* 1 *to* 6 *must be answered on* music paper, *and in the order in which they are put.*)

1. Put time signatures to



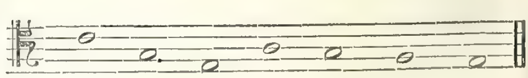
2. Write the signatures (essential sharps or flats) of *Fa* (F), *Sol* (G), *La* (A), and *Si b* (B*b*) *major;* and of *Do* (C) *Re* (D), *Mi* (E), and *Fa* (F) *minor.*

3. Transpose the following a third lower.

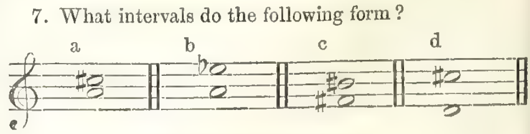
4. Write the scale of *Re* (D) *minor*, in every form with which you are acquainted.

5. Explain, by one or more examples of each, the following words:—Tetrachord, Syncopation, Augmented Second, Double Dot.

6. Write the following on the bass stave, at the same pitch.



7. What intervals do the following form?

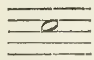


8. In what scale are these two notes?

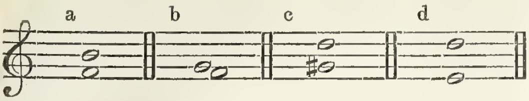
II. HARMONY, COUNTERPOINT, AND MUSICAL HISTORY.

(*Nos.* 1 *to* 6 *to be answered on* music *paper.*)

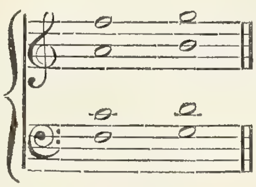
1. Place such a clef before the following as will make it *La* (A).



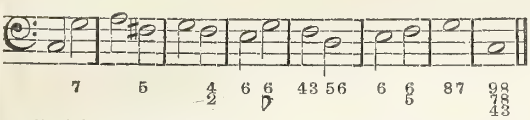
2. Resolve the following dissonances.



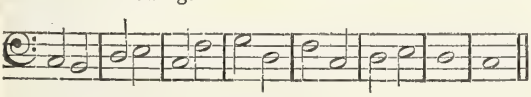
3. Correct the following, without altering the first chord.



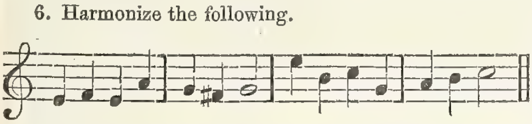
4. Add three parts to



5. Add a part in any kind of counterpoint above or below the following.



6. Harmonize the following.



7. State anything you know about English music and English musical composers in the seventeenth century.

FIRST WORKING MEN'S EXHIBITION AT VIENNA.

An Exhibition of this character has lately been held in Vienna. It appears, from the catalogue which has been issued, that this exhibition has been got up by certain individuals there, owing to the success which has attended such exhibitions in England.

Towards the end of last May the Minister of Commerce gave his assent to a request, made by Dr. Karl Helm, Ludwig Lobmeyr, Josef Nikola, and others, that a Working Classes Industrial Exhibition should be held in Vienna. The above-named gentlemen, with Herr Leon Mandel and others, declared themselves prepared to bear all the preliminary expenses.

On the 8th of June the programme was issued by the permission of the government. The Imperial Royal Horticultural Society lent their grounds gratuitously for the proposed purpose, and the press supported the movement in every way. Papers, descriptive of the origin and object of the exhibition, were then distributed among various Societies whose objects were the promotion of the industry of the working man, among which may be mentioned the Catholic Trade Society, the Society for the Promotion of Business among Native Jews, the Female School Society for Gratuitous Female Trade Instruction, the Female Charity Society (as regards its female trade instruction), the Imperial Royal School for the Education of the Blind, and the Home for the Maintenance of the Adult Blind. The Burgomaster lent the Common Council Chamber for the holding of a meeting, which took place on the 14th of June, at which Drs. Helm, Nikola, and Dr. Stamm gave full information relating to the holding of the exhibition. It had been the intention of the committee to give money prizes, but they ultimately decided, and stated in their programme, that for excellence in workmanship the men would receive silver medals, to be awarded by a jury of working men.

The project found support on all sides, and many persons contributed money for the purpose; and further, the Trades Union Society declared itself willing to co-operate in the awarding of prizes, and the like co-operation of known judges was promised, the distribution of prizes being arranged to take place at the close of the exhibition.

The following programme was issued:—

A Working Classes Industrial Exhibition, of the same character as those lately held in London, will be held in the Imperial Royal Horticultural Grounds, next the Town-park, on the occasion of the public *fêtes* in August.

1. To this exhibition will be admitted (*a*) articles useful for housekeeping, health, and daily life; (*b*) productions, models, and designs of articles which, although not of public use, are important in a scientific or artistic point of view, or which at least show the inventive genius of the exhibitor; (*c*) productions worthy of notice out of the ordinary line of the exhibitor's business.

On account of the great difficulty of making a strict and complete classification of the articles for Exhibition, they will be divided into the following heads, viz.:—

I. Objects of art.
II. Professional art work.
III. Trade productions.
IV. Female hand work.
V. Amateur work.
VI. Articles which are new in mechanism or in the application of physical or chemical science.
VII. Miscellaneous.

2. Persons desiring to exhibit must (*a*) reside in Vienna within the police radius; (*b*) belong either to the working classes, such as foremen, assistants, journeymen, handworkers, apprentices; or (*c*) be, as regards their work, amateurs; and (*d*) have made the exhibited work themselves.

3. Good workmanship will be rewarded, according to the awards of a jury of working men, by prizes (silver medals).

4. Exceptional articles, worthy of place in the Exhibition, suitable for the embellishment of the Exhibition, or affording information, as well as other objects, will be admitted, though not shown for prizes.

5. Exhibitors must bring the articles they exhibit at their own cost to the place of exhibition, and take them away on the day after its close. Articles not taken away on that day will be disposed of for the benefit of some charitable object.

6. The day of opening will be made known by special placards.

7. Allotments of space can be made until the 31st July, 1865, after which no more will be made.

The admitted articles must be brought to the place of exhibition the day before its opening, where they will be received from 8 a.m. to 7 p.m.

8. The Exhibition will be open daily from 8 a.m. to 7 p.m.

9. The price of admission will be on the opening day 30 kr. (7½d.); on other days 10 kr. (2½d.); children, half-price. All the profits will be appropriated to some useful public object.

BRITISH ASSOCIATION, 1865.

INDIA RUBBER CONSIDERED IN REFERENCE TO ITS APPLICABILITY AS AN INSULATOR FOR TELEGRAPHIC CONDUCTORS. BY WILLIAM HOOPER, ESQ.

The following paper was read in Section A, and again on the following day, in Section G, by request of that Committee:—

The difficulties which have preceded the successful issue of india rubber insulation are precisely the same which were encountered for many years after the introduction of this substance as a branch of manufacture. Native or raw india rubber, when in good condition, may be kept for years without sustaining any deterioration, but in certain stages of its manufacture it becomes susceptible of decay, which is accelerated by exposure to air and light. The decay of india rubber is now well known to be the result of oxidation, and is characterized by a gradual tendency to fluidity; its first stage of decay is recognized by a diminution of its elasticity, and by its becoming glutinous or sticky, and finally being reduced to a tarry-looking fluid, which state it always preserves.

The ultimate composition of india rubber is represented by the formula $C_8\ H_7$. The analysis of Dr. Miller accords, with tolerable exactness, with this formula—he found in 100 parts 85·82 carbon and 11·11 hydrogen. The sample which he analyzed, however, contained 3·07 oxygen, and evidently could not have been pure caoutchouc. Neglecting the oxygen, the composition of pure caoutchouc, as reduced from its empirical formula ($C_8\ H_7$), is 84·56 carbon, and 12·33 hydrogen, the difference in which from the results by Dr. Miller's analysis is practically nothing, and confirms the accuracy of the original analysis.

India rubber in a manufactured state contains more or less of its oxidized product, which produces the colour recognized in this substance, pure caoutchouc being colourless. The word caoutchouc should properly be applied to that pure principle of carbon and hydrogen which forms the greater part of manufactured india rubber.

The process by which india rubber is rendered suitable for the purposes of insulation, consists of an operation which involves its partial oxidation, and unless this oxidation is arrested, the india rubber becomes useless as a permanent insulator. India rubber, when thoroughly washed and dried, is masticated; by which means it becomes highly coloured, and is afterwards found to contain a variable amount of its oxidized product. By mastication, the india rubber is converted into solid masses or blocks, which are cut up into slabs or sheets; the sheets are again cut into tapes, which is the only form for applying it to telegraphic conductors. The tapes being put on the wires, another operation is required to reduce them into a perfectly uniform and solid covering; this has been usually effected either by the use of solvents or the direct application of heat, both of which plans are seriously objectionable. By the application of solvents the india rubber becomes more susceptible of oxidation, whilst the direct application of heat induces a molecular change more favourable to its oxidizing. Wires insulated by either of these means indicate a very high state of insulation when first made, but as the india rubber decays the insulation is reduced and ultimately destroyed.

About two years ago five lengths of india rubber insulated wires were supplied to the government for submersion in the Persian Gulf, which, with the exception of one, have failed almost entirely. I was favoured with a report from government a few weeks ago, made by Mr. F. C. Webb, from which it appears that the length remaining perfect is, at the temperature of 75° Fahr., three times better than the gutta percha insulated wires which form the core of the Persian Gulf Cable. Mr. Webb stated in his report that he did not know who were the respective manufacturers of these several lengths, but he brought home a piece cut from each length for identification. On my calling upon him, he placed the several pieces before me, and I had no difficulty in recognizing my manufacture. Mr. Webb at once said that it was off the length which he had reported to the government as being the only one that remained perfect. It will be seen from these numbers that it is the highest degree of insulation yet practically attained. A length of 1,610 yards, tested under a pressure of 6,000 lbs. per square inch, and the same length, tested again under pressure of 4,480 lbs. per square inch, maintained for nearly eighty hours, showed an increase in its insulation resistance; and on removal of the pressure it was not found to have diminished, as has been stated to be the case with some specimens of india rubber insulated wire. The length under this test contained two joints. The high results obtained from joints in my insulated wires have entirely removed all apprehensions on this important point; and there is no practical limit to the age of the material in which joints can be safely and reliably made. Five miles of my insulated wire, containing in each case eight and twelve joints, were uninterruptedly maintained at the temperatures of 75° and 95° Fahr. respectively for 240 hours, and on being reduced to the initial temperature were found to have suffered no permanent change.

The facilities offered by my process for producing insulated wires of nearly identical degrees of insulation, and for reducing the most minute fault, enable me to bring forward this system as one by which absolute freedom from defects can be insured. This is a point intimately connected with the success of submarine telegraph cables; for it frequently has happened that minute faults have on submergence enlarged into sources of serious annoyance. The central position of the conductor is unaltered by any elevation of temperature; and, as it maintains a high degree of insulation at 150° Fahr., or even higher temperatures, it is peculiarly applicable for tropical seas. In its resistance to mechanical injury it far surpasses all other materials which have been tried for insulating telegraphic wires. The low inductive capacity of india rubber renders it especially suitable for telegraphic cables, and by my process the low induction of india rubber is maintained.

Sir Charles Bright, Mr. Latimer Clark, and Professor William Thomson have favoured me with the details of some very interesting investigations which they have gone through, on the qualities of my insulated wires; and, as Professor Thomson was not aware that Sir Charles Bright and Mr. Latimer Clark were giving their attention to the subject, it is highly satisfactory to find how nearly they agree in reference to the inductive capacity compared with gutta percha. Professor William Thomson found the induction of my wire as compared with that of gutta percha to be as 100 to 135, whilst Sir Charles Bright and Mr. Latimer Clark found it as 100 to 136. Mr. Wildman Whitehouse examined a length of one of my higher insulated wires, which he found as 100 to 160. As the rate of signalling is governed by the retardation arising from inductive charging, the transmission of messages will be inversely as these numbers, that is to say, that 135 to 160 messages could be sent through an Atlantic cable by using a conductor insulated with india rubber according to my process, whereas 100 only could be sent in an equal time by using a conductor insulated with gutta percha. This has a most important bearing in a financial point of view, since the cost of the insulation by my method would not be greater, and in some of its forms considerably less, than that paid for insulation by gutta percha.

(Several lengths were shown to the sections, and also a diagram illustrating the effects of temperature, as compared with gutta percha.) The mathematical properties of the curve were, for the temperatures determined on my core, similar to those obtained with gutta percha, but the differences in the insulation for increase of temperature were not so great as are observed to take place with gutta percha.

The following table gives the insulation resistances in millions of B. A. units of my core and gutta percha, at different temperatures:—

	0° Cent.	24° Cent.	38° Cent.
Gutta Percha (Persian Gulf Core)...........	3205	... 170	... 45
Mr. Hooper's Core......	71036	... 6328	... 2283

A length containing a joint that had been kept in a boiling solution of salt (220° F.) for twenty hours, was placed in a vessel to be again heated to that temperature

and tested; but the committee decided that it was unnecessary to test it, or any of the specimens and joints exhibited.

The specimens and joints had been made at different periods during the last four years, and were shown for the purpose of being examined, to see that they had not suffered any change. Amongst the specimens was a length of half a mile with a joint, cut from the five miles referred to above.

During the discussion which ensued,

Mr. SIEMENS, F.R.S., expressed his concurrence with Mr. Hooper's remarks on the value of india-rubber insulation, as compared with that of gutta percha, except that india-rubber improves in insulation under pressure; with that exception he considered Mr. Hooper had kept within rather than gone beyond their relative properties. Difficulties had hitherto been found in the application of india-rubber as an insulator, and it would be interesting to the Section to know how Mr. Hooper had overcome them.

Mr. FLEEMING JENKIN, F.R.S., stated that he had for some years been acquainted with Mr. Hooper's method of insulation by india rubber, and he had never seen a length of his manufacture that indicated loss or decay. He considered the difference between the result of testing under pressure by Mr. Siemens and that by Mr. Hooper was caused by Mr. Hooper's process in consolidating the india rubber; his experience tended to confirm the statements made by Mr. Hooper. He thought it exceedingly desirable that Mr. Hooper's cable should be practically tested by being submerged and worked, as it was evident that for long lengths and tropical seas it seemed to possess very valuable properties as compared with gutta percha.

Mr. GASSIOT, F.R.S., said he thought the experiments in connection with the submergence of the two Atlantic cables had demonstrated that the two mechanical difficulties of the task could be overcome with a moderate degree of care and attention; and the most important consideration was that it had been demonstrated possible to lay a cable between Ireland and Newfoundland, but they must take care and not do as had been done in other cases, viz., lay down a cable which would only last two or three years. In this connection Mr. Gassiot pointed out the importance of the cable produced by Mr. Hooper, although he questioned if the time had arrived for a final experiment in the laying down and working of an Atlantic cable. He thought the bearing of india rubber in its various qualities as an insulator ought to be satisfactorily and conclusively determined before the laying of another cable in the Atlantic was attempted. If they went on from year to year unsuccessfully, they would absorb any amount of capital; and the citizens to whom they must go for material support would close their purses; whereas, if they only waited the result of the experiments being diligently prosecuted by electricians, they would be able to come forward with a scheme which would not only be a success, but practically with the best cable. There would then be no difficulty in raising capital, for there was no doubt that the Atlantic Telegraph would be laid; but before again embarking on the enterprise every experiment should be made. This was the only prudent and safe course to adopt. He understood the Government had sent out two or three years since several lengths of insulated wire by different manufacturers to Kurrachee, including one by Mr. Hooper, to be practically tested by submersion in the Indian seas, and a report had been lately furnished to the Government stating that all of them except the length supplied by Mr. Hooper had failed; the report to Government went on to state that Mr. Hooper's cable tested three times better than the Persian Gulf cable, which is insulated with gutta percha; the Government had, in consequence, given Mr. Hooper an order for about fifty miles of his cable, to be supplied forthwith. He considered the Atlantic Company might well follow the example set by the Government.

Fine Arts.

GRAND PRIZE OFFERED BY THE FRENCH ACADEMY OF BEAUX-ARTS.—The Academy, as trustee of the funds bequeathed by M. Bordin, has offered a prize for a subject which is peculiarly interesting when taken in connection with the coming Universal Exhibition. The theme selected is stated in the following terms:—"To examine and demonstrate the amount of influence exercised on art by circumstances, national, political, moral, religious, philosophic, and scientific. To show to what extent the most eminent artists have shown themselves independent of, or affected by such influence." The prize is, nominally, a gold medal, of the value of 2,900 francs, or £116, and the essays are to be sent in to the Secretary of the Institute on or before the 15th of June, 1867.

BUST OF RICHARD COBDEN FOR VERSAILLES.—While Mr. Woolner, the well-known English sculptor, is executing a bust of the late Richard Cobden to be presented by Mrs. Cobden to the Emperor Louis Napoleon, M. Olivia, a French sculptor, has been engaged on another bust, which is just finished, and which was ordered by the Emperor to be placed in the gallery at Versailles.

Manufactures.

AVENTURINE.—The composition of Venetian aventurine or avanturine, a vitrified substance containing specks of gold, so much used for brooches and other ornaments, remained for a long time a secret, but two chemists, M.M. Frémy and Clemandot, discovered a method of producing it. Their method was to fuse together and keep heated for twelve hours a mixture of three hundred parts of pounded glass, forty parts of protoxyde of copper, and eighty parts of oxyde of iron, and then to allow the mass to cool very gradually, and in this manner they obtained fine specimens of this artificial precious stone. M. Pelouse, another French chemist, has just communicated another method to the Academy of Sciences; he takes 250 parts of fine sand, 100 parts of carbonate of soda, 50 of carbonate of lime, and 40 parts of bichromate of potass. The glass or enamel thus obtained contains from six to seven per cent. of oxyde of chromium, of which about half is combined with the glass, while the rest remains free in the form of those brilliant metallic specks which give the peculiar character to the composition. The Parisian lapidaries who have operated on this new material, give a very favourable account of it as likely to furnish an important material to the jewellers' trade; it is said to be equal to the finest old Venetian aventurine, the metallic lustre of the enclosed specks being very brilliant, and the composition so hard that it will readily scratch and cut glass, and, consequently, is susceptible of a very high polish, and not liable to have its surface destroyed by ordinary abrasion.

SPLENDID TRIBUTE TO A MANUFACTURER IN FRANCE.—M. Carrier Belleuse, the French sculptor, who for several years was engaged in the Staffordshire Potteries, has been entrusted with the execution of an allegorical group in bronze and marble, which is to be presented to M. Henri Schneider, of the great iron works at Creusot, by the commercial and working population of the place (the subscription list containing more than nine thousand names), on the occasion of the birth of that gentleman's first child. The group is to represent Industry endowing the world with light, peace, and plenty, and the base will be decorated with three figures, representing Mining, Metallurgy, and Mechanics. The works at Creusot are, perhaps, the most important in France, and well known to all who are acquainted with engineering on the Continent. After the death of the Comte de Morny, M. G. O. Schneider performed the duties of President of the Assembly with great distinction.

Industrial and Artistic Exhibition at Bordeaux.—The Bordeaux Exhibition has more than fulfilled the expectations raised concerning it; the number of exhibitors exceeds two thousand, and the buildings are almost inconveniently crowded with objects of industry and art. Besides agricultural and industrial materials and products, the exhibition includes a retrospective museum, and is surrounded by supplementary buildings, in which a considerable number of machines are exhibited in movement. This exhibition, like all others that have taken place recently in France, shows how vast a stride has been made in that country within a few years in mechanical, agricultural, and other industries. The contents of the Bordeaux Exhibition consist principally of machinery and metal work, clock and watch work, jewellery, cabinet ware, carriages, cutlery, arms and ammunition, carpets and tissues, agricultural machinery and products, to which latter section the Imperial Government has contributed an important collection of Algerian produce. A great misfortune happened the other day to the exhibition; the rain fell in such enormous quantities and so suddenly that the drains were insufficient to carry off the flood of water, which inundated a considerable portion of the annexes. At one moment a boat might have passed along some of the main avenues of the building, and a number of visitors were obliged to seek refuge for a time on planks and other floating materials, and wait until the waters had subsided. The buildings being temporary, and of very fragile construction, there was great danger that they might give way; as it is, the mischief done to steel and other articles must be considerable.

Commerce.

The Cotton Trade.—" Amongst many other gratifying evidences of the future prosperity of the cotton trade, we notice with pleasure," say Messrs. Travers, " that the revenue arising from the cultivation of the cotton plant in Egypt bids fair to be so large as to render unnecessary the Pacha's recent negotiations for a loan of three millions. Enormous as the destruction of property must have been during the American war, and disastrous as its effect was upon us, one great advantage has certainly arisen from it, and that is, the general impetus to the cultivation of cotton in all lands where it is found practicable. America has hitherto been considered as almost the only quarter to which we should look for our principal supplies of cotton; but our daily increasing experience, stimulated, if not actually called into existence, by the painful scarcity entailed upon us by the American war, has taught us that there are very few countries within the limits of the tropics where the cotton plant may not be cultivated with ease and profit. In the course of some years we may hope to see such a state of things actually in existence; and we shall not then witness that remarkable phenomenon—our entire system of commercial finance affected to a serious extent by so unimportant a consideration as the accidental and partial deficiency of one single article of produce from one quarter of the world. The President of the Manchester Chamber of Commerce stated on a recent occasion that England was prepared to consume as much cotton as could be produced in the whole world for the next three or four years. Without entirely endorsing so strong a statement as this, we can, nevertheless, express our firm conviction that the cotton trade is destined to attain a much larger development than it has as yet achieved."

Coffee.—The following remarks on the growth and future prospects of the coffee plant, are from reports by Her Majesty's Consuls at the localities mentioned:—*Feejee.*—" Coffee has been introduced here from Tonga, and there are at present 20,000 trees in a flourishing condition; two-thirds of these will bear fruit next year. Hitherto the berries have been required for seed, as the trees so produced are found to be healthier and more productive than those imported. In the course of a few years we may hope that coffee will form an important export from the Feejee and Friendly Islands. In the latter group (Tonga) coffee trees raised from seed will bear fruit the fourth year." *Borneo.*—" Little attention has been paid to the growth of the coffee plant; from all accounts, however, the hill climate would appear to be very favourable to its growth. Coffee is largely exported from the neighbouring islands of Celebes and Java; it is, therefore, to be hoped that it will some day be exported also from this province." *Bremen.*—" The coffee trade was, compared with former years, unsatisfactory and small. Owing to bad harvests in the coffee-growing countries, prices there became too high compared with those in Europe, and the stock at Bremen during the first part of the year was so small that little or no business was done: however, after the great autumnal auctions in Holland, the coffee trade rallied a little, but never attained that importance which used to make it, next to tobacco, the principal branch of business here." *Hamburg.*—Hamburg is the largest coffee market in Europe, and supplies both the interior of Germany and the countries to the north. The quantity of coffee, of all sorts, imported last year, was 784,428 cwts. The greatest quantities were furnished by Venezuela, Brazil, and Java; but the coffee of St. Domingo, and that of Porto Rico were also in good demand. Nearly half of the coffee brought to the Hamburg market is originally imported at Altona, and transferred from thence across the frontier. Prices have been constantly rising for some years past." *Spain.*—" Coffee is an article which the Californian market will take off to a large extent. In this quarter the plantations which have been commenced are not yet in a sufficiently forward state to be able to export, but they promise well for the future."

Colonies.

Trade at Melbourne.—The official returns show that the value of the imports and exports at the port of Melbourne, from the 1st January to 19th August, 1865, as compared with the corresponding portion of the previous year were:—Imports, 1864, £9,068,738; 1865, £7,904,724. Exports, 1864, £7,521,155; 1865, £6,512,519. There is, therefore, a decrease during the present year in the value of imports of £1,124,014, and in the value of exports, £1,008,626. These figures are rather significant with respect to the operation of the new tariff, not so much as regards the consumption in the colony, but as affecting its intercolonial trade as the chief entrepôt for Australia.

Building at Melbourne.—A steady activity has recently prevailed amongst the building trades in Melbourne for several months, and the results are visible in the shape of new buildings in all or most of the main thoroughfares of the city. The erection of dwelling houses in the outskirts and suburbs of Melbourne has been carried on very extensively, and a marked improvement may be discerned in the character of the dwellings built now over that of those which were erected in earlier years; but besides, there have been a large number of buildings of importance and conspicuous appearance added to the city within the last few months.

South Australia.—The harvest of unprecedented bounty which was bestowed upon this colony in December, 1863, the high prices for which markets were found for nearly the whole of the crop, the increasing productiveness of many mines both of copper and lead, and the satisfactory state of the London wool market, combined to render the year 1864, and some portion also of 1865, a period of great prosperity to the producing interests of the colony, in which prosperity the manufacturing, commercial, and labouring classes shared naturally; but this season the profits of the mining interest must be seriously diminished by the recent fall in the value of copper, both in England and India, and the visitation of drought is of

serious interest to those concerned in pastoral pursuits, and has caused a nearly general failure of the lambing throughout the most favoured districts of the colony. The impossibility in many places of fattening stock for market, and in others of driving them there if fattened, is annoying; all these combined tend to check the growth of wool, which will seriously reduce the quantity and deteriorate the quality of this year's clip.

Immigration to Australia.—The influence of the gold discoveries on immigration and of immgration on wages are curiously shown by the following figures:—In 1850, 1,182 male immigrants arrived in Sydney, and wages were 4s. 6d. per diem; in 1851, the male immigrants numbered 742 (the news of the gold discovery in May not having begun to operate), and wages were 7s. 8d. upon an average of the year; in 1852, the number of male immigrants was 1,635, and the rate of wages 9s.; in 1853, 2,706 male immigrants arrived, and wages rose to 16s.; in 1854, 2,816 male immigrants arrived, and wages rose to 21s. per day; in 1855, the number of male immigrants was 5,141, and wages were 17s.; in 1856, 2,884 male immigrants arrived, and wages dropped to 13s.; in 1857, 4,415 male immigrants arrived, and wages rose to 14s.; in 1858, 2,860 male immigrants arrived, and wages dropped to 10s. 6d.; in 1859, 2,112 male immigrants arrived, and wages were still 10s. 6d.; in 1860, 1,351 male immigrants arrived, and wages were 11s.; in 1861, 794 male immigrants arrived, and wages were 11s. 6d.; in 1862, 1,172 male immigrants arrived, and wages were 10s.; in 1863, 1,966 male immigrants arrived, and wages were 10s. A variety of causes influenced the rate of wages besides the number arriving from Great Britain; but it will be seen from this analysis that the arrival of male immigrants, so far from depressing the labour of existing workmen, in some instances advanced it in a very marked degree, and can in no instance be assigned as a cause of depression.

Publications Issued.

Inorganic Chemistry for Science Classes. By Fearnside Hudson, F.C.S., F.A.S.L. (*Whitaker and Co.*) This work is intended for the use of beginners in the study of chemistry, more especially for students of science classes.

The Tannin Process. By C. Russell. (*Robert Hardwicke.*) This is a second edition of Major Russell's original work on the dry process of photography invented by him. To this edition is added an appendix, giving the results of his later experience in its working. This process, as managed at first, had one serious fault, which rendered it less suitable for ordinary landscapes than for some other kind of subjects. The use of tannin the author considers to be attended with many advantages, and he has used his best endeavours to find a means of correcting and improving the process.

Forthcoming Publications.

The Slide Valve Practically Considered. By N. P. Burgh, engineer. Post 8vo., cloth, with eighteen illustrations. (*E. and F. N. Spon*).—This work, which will be ready on the 1st of November, will be divided as follows:—Chap. I.—The antecedents of the Slide Valve and Steam Ports in the Cylinder. Chap. II.—The Proportion of Valves and Ports in the Cylinder, Common and Exhaust Slide Valves. Chap. III.—Equilibrium and Double-Ported Valves. Chap. IV.—The proper mode of attaining the correct amount of Lap. Chap. V.—The effect of Expansion by the action of the Slide Valve. Chap. VI.—The delineation of the Path of the Crank Pin. Chap VII.—General Observations.

Notes.

Paris Exhibition of 1867.—A perfect army of workmen is now engaged in draining and otherwise preparing the Champ de Mars for the exhibition building, a very laborious task, for the ground is not only very low, but has never been drained in any way; this preparatory work will, however, be performed in the most thorough manner, and the basement of the building will be underlaid with a thick mass of concrete, so that the character of the site will be totally changed as regards level and consequent conditions. The contract for the erection of the great outer zone or gallery of the building, in which the working machinery, and what was called in 1862 the "Process Court," will be placed, has been taken in equal shares by two of the most important firms in France, namely, MM. Gouin and Cie., and MM. Cail and Cie. This gallery forms the outer shell of the building, as may be seen by the plan published from official documents in the *Illustrated London News*, and its face will include the whole of the architectural features of the building. The inner gallery, that which surrounds the central garden, and which is to be devoted to the fine arts, will also, like the outer, be constructed in a very substantial manner; these two portions taken together form in fact the shell of the building, and will act as abutments with respect to the roof, which will cover the whole of the intervening space. The *Journal* of Charleroi, one of the principal centres of manufacture, and especially of engineering, in Belgium, says that a society has been formed at Gilly, in order to enable artizans to visit Paris and examine and report for themselves on the inventions and improvements to be found in the exhibition. The subscription is only seven pence a fortnight, and each subscribing member will have his railway ticket gratis, besides board and lodging in Paris for three days. It is said that a great number have joined the society. Similar arrangements are on foot in France.

Fire Extinguisher.—A curious apparatus called *l'Extincteur* was tested a short time since on the edge of the Seine, in Paris, and is now offered to the public. It has very much the appearance of one of those *fontaines* carried on the backs of the men who sell liquorice water in the streets of Paris, under the odd name of *Coco*, but it is in fact a soda water machine, containing, in separate compartments, solutions of a carbonate and of an acid, which remain quiescent until a stop-cock is turned, when they give rise to the production of carbonic gas, which causes the water contained in the apparatus, and which of course holds a certain amount of the gas in suspension, to flow from a jet pipe with great force.

International Postal Arrangements.—Another step has been made in international postal reform by a convention passed between France and Belgium on the 12th of the present month of October, and officially announced in the *Moniteur*. By this new convention, the postage of an ordinary letter, weighing one-third of an English ounce, will be reduced from 40 to 30 centimes when prepaid, and from 60 to 50 centimes when sent unpaid; the postage of newspapers and periodical works, from ten to six centimes for 40 grammes, or $1\frac{1}{3}$ of an ounce, while other printed matter will only be liable to a tax of five centimes, or one half-penny, for the same weight; the postage of documents and business papers will be reduced to 50 centimes per 200 grammes; post-office orders will be granted for sums not exceeding 200 francs. The time when the new regulations are to come into operation is not yet published. The effect of the convention, as regards newspapers, will be to diminish the cost of journals sent from one country to the other to the extent of 15 or 16 francs per annum.

Public Works in France.—The demolitions, to prepare the way for a grand avenue which will form a direct line from the Théâtre Français to the new Opera House, are proceeding rapidly in the neighbourhood of the Rue

Richelieu. The new boulevard, or avenue, which is to be named either after the Empress or the great tragedian Rachel, will clear away a shabby and disreputable quarter, and let in light and air where both are much wanted. The old campanile tower, over the central entrance of the Hôtel de Ville, has been taken down, and a new one is now being erected in its place, and will shortly be finished. The conversion of the huge and irregular cavity (left by the quarries, which were worked for many years in the Buttes de Chaumont, near Belleville, to the north of Paris) into a public pleasure ground, is going on rapidly, and the works are, perhaps, the most curious of the kind that have yet been undertaken, and are well worthy of a visit. They include the formation of two lakes, with a fall of water over rocks more than 200 feet high, reproducing the famous cascade of Tivoli, at Rome, and the creation of *fac-similes* of the ancient cave of the Sibyl and of the Temple of Vesta. Standing in the midst of the lower lake, into which the water from above falls, is a natural rock, about a hundred feet high, which is being made accessible by means of two bridges, and of winding paths from the base to the summit. The progressive growth of Paris is shown by the following figures:—At the commencement of the fourteenth century there were but 310 streets in the city, and by far the greatest part of these were, in fact, narrow lanes, while all were unpaved, ill-lighted, and filthy in the extreme. During the reign of François Premier, in 1545, the number of streets, as shown by existing tax-returns, was only 427. In the time of Henri Quatre, Jacques Sanguin (the provost of the merchants) estimated them for taxing purposes, at 510, including, it is supposed, courts and alleys. At the beginning of the last century, in the reign of Louis Quatorze, when the Court of Versailles was the most splendid in the world, the Paris streets only numbered 635. In 1785, when the boundaries of the city were extended, the streets were increased to 997; and eighty years later, that is to say, 1859, they had reached to 1,433. At the present moment, and including the ancient banlieues, now encompassed by the extended boundary of the fortifications, the number of public ways, streets, courts and alleys, amounts to 2,702. A project of great national importance is now under consideration at the Hôtel de Ville, namely, the construction of a canal from Paris to Pontoise, through the Valley of Montmorency, in order to cut off the numberless sinuosities which render the navigation of the Seine extremely tedious. Pontoise is situated at the confluence of the rivers Viosne and Oise, at about nineteen miles from Paris, and has an important trade in corn, flour, and cattle. The proposed canal will debouch in the Oise, near St. Ouen l'Aumone, and join the Canal of St. Denis at Aubervilliers, near Paris; one or more small branches are included in the project, to which it is not expected any objection will be raised, and the cost of the whole work is estimated at between three and four hundred thousand pounds.

MEETING FOR THE ENSUING WEEK.

Thurs...Linnæan, 8. 1. Professor Oliver, "On a New Genus of *Bignoniaceæ*." 2. Mr. Harland Coultas, "On the Law of Leaflet-genesis."
Chemical, 8. Professor Church, "On some New Cornish Minerals."

Patents.

From Commissioners of Patents Journal, October 20th

Grants of Provisional Protection.

Bricks—2571—V. J. B. Germaix.
Cabs, checking the payment of fares in—2029—H. A. Bonneville.
Carriages, breaks for—2561—A. R. Shaw.
Carriages propelled by manual power—2623—T. Du Boulay.
Cast steel, &c., manufacture of—2137—R. A. Brooman.
Carts, &c., breaks for—2617—T. Warburton.
Compound cylinder engines—2587—J. Howard.
Cork, cutting and shaping—2393—L. Villette.
Cotton, &c., machines for opening and cleaning—2557—E. Marsland and P. Williams.
Dishes, &c., revolving cover for—2531—C. P. Button.
Doubling machines, flyers used in—2611—M. Walker.
Electrical telegraphy—2217—R. Laming.
Fire-arms, breech-loading—2553—J. Millar and B. Burton.
Fires, apparatus for extinguishing—2559—W. H. Phillips.
Fires, apparatus for lighting and reviving of—2329—C. J. Webb.
Gas lamps—2615—J. J. Parkes.
Gun carriages—2569—G. W. Rendel.
Hair, machinery for brushing—2417—F. T. and J. H. Brandreth.
Harness for driving machinery—2619—J. Crutchett.
Hydraulic pressure engines—2445—J. Dreisorner.
Injections to the human body, administering—2555—W. R. Barker.
Iron and steel, manufacture of—2461—T. F. Cashin and J. F. Allender.
Leather—2357—L. G. Sourzac and L. Bombail.
Lucerne plant, making paper, &c., from the—2523—C. D. Abel.
Mangling and callendering—2597—R. Walmsley.
Measuring, rules for—2613—A. Nicholls.
Metallic stuffing box—1555—V. Duterne.
Nap or pile of nap or pile fabrics, cutting or shearing the—2547—W. B. Stocks, J. Whitwham, and W. Blakey.
Pianofortes—2607—G. G. Rich.
Railway carriages and locomotives—2621—M. Henry.
Railway carriages, &c., construction of—2581—H. G. Craig.
Rotary engines and pumps—2567—R. A. Brooman.
Scent and smelling bottles—2599—T. Miles.
Sewing machines—2551—M. Henry.
Sewing machines, wheel feed for—2313—J. Hose.
Spoons, forks, &c.—2397—D. J. Fleetwood.
Sulphurous acid, obtaining—2483—R. Reece.
Ventilating apparatus—2609—J. G. Woodward.
Vessels, propelling—2601—W. Clark.
Wheat, &c., grinding—2485—B. Wren.
Wooden spills—2577—T. Machin.
Wool, &c., washing—2039—J. Petrie, jun.
Writing, pens used for—2573—R. M. and D. Cameron.
Wrought iron girders—2593—J. Homan.

Invention with Complete Specification Filed.

Shirts collars and bosoms—2627—V. A. and V. J. Messinger.

Patents Sealed.

1110. T. Greaves and J. S. Wright.	1375. R. T. Birt.
1113. E. Wilson.	1378. W. Eassie.
1115. A. C. Hermann.	1474. C. H. Murray.
1122. R. Canham.	1513. W. E. Newton.
1123. C. Hall.	1541. W. E. Newton.
1124. O. C. Evans.	1554. A. C. Henderson.
1127. J. H. Wilson.	1561. W. E. Newton.
1130. A. Grainger & C. M. Girdler.	1735. W. E. Newton.
1141. W. E. Gedge.	1752. J. Calvert.
1143. J. J. Parkes.	1756. J. F. Jones.
1150. T. Walker.	1762. S. Wright.
1153. J. N. Brown & T. D. Clare.	1785. C. F. Claus.
1154. J. N. Brown & T. D. Clare.	1787. J. F. Jones.
1157. W. Elder.	1843. J. Saunders and J. Piper.
1187. T. C. March.	1868. J. P. Wint.
1189. A. C. Henderson.	1944. W. Barton.
1209. G. Johnson.	2049. A. V. Newton.
1225. T. H. Campbell.	2205. H. A. Bonneville.
1360. J. Worrall and T. Hughes.	

From Commissioners of Patents Journal, October 24th.

Patents Sealed.

1168. F. D. P. J. Cabasson.	1195. A. Wyllie & J. McF. Gray.
1174. W. H. Smith.	1200. G. P. Dodge.
1178. H. W. Wood.	1201. W. Clark.
1179. S. Harvey.	1202. P. A. F. Moreau.
1181. J. F. Feltham.	1206. D. Y. Stewart.
1182. R. A. Brooman.	1239. W. Clark.
1184. A. Grainger & C. M. Girdler.	1254. G. Peel and I. Mason.
1188. E. Moore.	1386. W. Davey.
1190. E. McNally.	1434. J. H. Johnson.
1191. J. Bernard.	2044. W. Pouock and J. Stobo.
1193. R. Ferrie, J. Murray, and A. Wilson.	

Patents on which the Stamp Duty of £50 has been Paid.

2804. H. Wickens.	2838. G. Haseltine.
2852. W. S. Gamble.	2846. H. H. and J. F. G. Kromschroeder.
2956. M. and R. M. Merryweather, and E. Field.	2853. A. Chaplin and G. Russell.
2842. J. Spence.	2862. R. A. Brooman.
2849. T. Greenwood.	2888. W. J. Williams.
2821. J. Clark.	2979. J. H. Johnson.
2834. J. T. Cooke.	2854. J. Turnbull.

Patents on which the Stamp Duty of £100 has been Paid.

2321. C. West.	2408. B. Foster and P. Smith.
2332. A. Allan, T. Whimster, and R. Gray.	2695. J. Tangye.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, NOVEMBER 3, 1865. [No. 676. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

Institutions.

The following Institutions have been received into Union since the last announcement:—

Bessbrook (Newry), Mutual Improvement Society.
Watt Institution and Edinburgh School of Arts.

Notice to Members.

The One-Hundred-and-Twelfth Session of the Society will commence on Wednesday, the 15th inst., when the Opening Address will be delivered by Wm. Hawes, Esq., F.G.S., Chairman of the Council.

The following are the dates of the Wednesday evening meetings, the chair being taken at Eight o'clock:—

1865.	November	—	—	15	22	29
,,	December	6	13	20	—	
1866.	January	—	—	17	24	31
,,	February	7	14	21	28	
,,	March	7	14	21	—	
,,	April	4	11	18	25	
,,	May	2	9	16	23	30
,,	June	—	—	—	27*	

For the Meetings previous to Christmas, the following arrangements have been made:—

November 15.—*Chairman's Opening Address.*

November 22.—"On Water Supply, especially in Rural Parishes and Districts." By J. Bailey Denton, Esq.

November 29.—"On the Proposed Purchase of Railways by the Government." By William Hawes, Esq., F.G.S.

December 6.—"On London Milk." By J. Chalmers Morton, Esq.

December 13.—"On the Graphotype, a Process for producing from Drawings, Blocks for Surface Printing." By Henry Fitz-Cook, Esq.

December 20.—"On Parkesine, its Composition, Manufacture, and Uses. By Owen Rowland, Esq.

The Cantor Lectures for the ensuing Session will consist of Three Courses, to be delivered by G. W. Hastings, Esq., LL.D., Barrister-at-law; Fleeming Jenkin, Esq., F.R.S.; and Dr. F. Crace Calvert, F.R.S.

The following are the particulars of Mr. Hastings's course:—

Lecture I.—Monday, November 27th.—"The Effects of the Discovery of the Precious Metals on the Ancient Civilisation of the Mediterranean."

Lecture II.—Monday, December 4th.—"The Effects of the Discovery of the Precious Metals on Modern Civilisation.

Lecture III.—Monday, December 11th.—"On Copyright."

Lecture IV.—Monday, December 18th.—"On Limited Liability."

The lectures will commence each evening at Eight o'clock.

These Lectures are open to Members, each of whom has the privilege of introducing one Friend to each Lecture.

* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

Proceedings of the Society.

CANTOR LECTURES.

"On some of the most important Chemical Discoveries made within the last Two Years." By Dr. F. Crace Calvert, F.R.S., F.C.S.

Lecture IV.

(Continued from Page 743.)

Delivered on Tuesday, the 25th of April, 1865.

On some of the Discoveries in Agricultural Chemistry.

Before asking your especial attention to some of the most important mineral matters which exist in soils, I wish to say a few words on some of the researches published a few years since by Professor Way, in which that gentleman showed that soils had the power to retain with great tenacity certain mineral matters, which, although soluble in water, could not be removed from soils even when brought into contact with great quantities of water. He further demonstrates that if he made to percolate through a given quantity of soil certain soluble salts, such as those of soda, potash, and ammonia, these would be retained in the soil, whilst the acids with which these bases had been combined, would unite with some of

the elements previously existing in the soil, pass off, and the alkalies themselves remain fixed. Thus, according to him, the retentive power of soils was due to the presence in them of a small quantity of double silicate of alumina. Thus, for instance, a double silicate of alumina and soda, when brought in contact with lime, will part with soda and take up lime; but if this silicate, in its turn, is in presence of magnesia, the lime will pass in solution and the magnesia be retained. If, then, a salt of potash is employed, the magnesia will be removed from the double silicate and the potash take its place. If ammonia be brought in contact with the above silicates, except that of potash, it will substitute itself for soda, lime, or magnesia. These valuable researches prove to farmers that they have nothing to fear as to the loss of any valuable manure, such as compounds of ammonia and potash, which they might employ as manure on their lands, even if these were drained, for the potash or ammonical salts employed by them as manures and spread on the surface, would not pass off in the drainings of the land, but be retained by the soil under the form of a double silicate until required by plants, and decomposed under the influence of that mild but still all-powerful force called vitality. The researches of Professor Way have been extended by those of Dr. Voelcker, who, instead of employing simple salts, employed complicated liquids on various classes of soils, namely, calcareous clay soils, and ferruginous, sterile, sandy soils, and obtained the following results:—

1. That the calcareous clay soil absorbs about six times as much ammonia from the liquid manure, as the sterile sandy soil.

2. That the liquid manure in contact with the calcareous clay soil becomes much richer in lime; whilst during its passage through the sandy soil, it becomes poorer in lime.

3. That the calcareous soil absorbs much more potash than the sandy soil.

4. That chloride of sodium, in conformity with the results of other observers, was not absorbed to any extent by either soil.

5. That both soils removed from the liquid most of the phosphoric acid.

6. That the liquid in passing through the calcareous soil becomes poorer; and, on the other hand, in passing through the sandy soil becomes richer in soluble silica.

These researches of Dr. Voelcker led him to a somewhat different conclusion to that adopted by Professor Way. He does not think that the silicates of ammonia and magnesia that exist in soils, have all the retentive power attributed to them by Professor Way, but that potash and ammonia are retained in soils by the peroxide of iron and alumina which they contain, acting as weak acids with respect to the alkalis. He also considers that it is the same oxides which act as fixing agents of the phosphoric acid that may be added on soils as manure, under the form of super-phosphate of lime, or similar compounds. The researches of P. Thenard, Way, and Voelcker, point to the interesting fact that some of the most apparently useless elements in soils, such as alumina, oxide of iron, &c., are in reality the most useful, for although they do not take an active part in promoting vegetation, still they are the medium by which essential substances, such as fumic acid, phosphoric acid, potash, and ammonia, are retained and stored in soils until required to promote growth and vegetation.

Before drawing your attention to a few of the substances that a soil should contain, not only to enable it to support vegetation but to promote it in a high degree, I deem it my duty first to give here a few tables which shall give you an idea of the various mineral matters which chemists have found to exist more or less abundantly in vegetables, and which are found to compose the ashes left by vegetable matters when incinerated. The first table gives the amount of mineral matters in a thousand parts of many of our ordinary agricultural products:—

Mineral Matters in Plants in 1,000 Parts.

Wheat, about	20
Barley	30
Oats	40
Rye	20
Maize	15
Beans	30
Peas	30
Potatoes	8 to 15
Turnips	5 to 8
Carrots	15 to 20
Wheat straw	50
Barley straw	50
Oat straw	60
Rye straw	40
Meadow hay	50 to 100
Clover hay	90
Ryegrass hay	95

The second table gives you an outline of the relative proportions of some of the most important mineral substances existing, in the ashes of several of the commonest cereals and roots cultivated by our farmers:—

Mineral Matters in Plants.

	Wheat.	Barley.	Oats.	Rye.	Potatoes.	Turnips.
Potash	237	136	262	220	557	419
Soda	91	81	—	116	18	51
Lime	28	26	60	49	20	136
Magnesia	120	75	100	103	52	53
Oxide of iron	7	15	4	13	5	13
Phosphoric acid	500	390	438	495	125	76
Sulphuric acid	3	1	105	9	136	136
Silica	12	273	27	4	42	79
Chlorine	—	traces.	3	—	42	36
	998	997	999	1,009	997	999

These tables naturally point out the great variety of mineral matters that enter into the composition of the ashes of plants, and also will familiarise your minds with the important relations which some of those minerals have to the growth of plants which contain them. But before adverting to the part which some of these minerals play in vegetation, it is desirable that I should refer to the relative quantities of mineral matters taken from the soil where they are grown, in what is called by farmers a rotation of crops.

Rotation of Crops.—Quantity of Produce Removed from One Acre of Ground.

			lbs.
1st year	—Turnips	Bulbs	51,000
		Tops	14,000
2nd „	—Barley	Grain	2,116
		Straw	2,040
3rd „		Clover	2,030
		Ryegrass	2,060
4th „	—Wheat	Grain	920
		Straw	3,570
			77,736
	Moisture	19,230	
	Mineral	1,284	
			20,514
	Organic		57,222

Although these tables illustrate the quantity of the mineral matters, their variety, and relative proportions existing in plants, and lastly the total amount of the various minerals which a rotation of crops removes from the soil, still they do not point out to you which are the

most essential to vegetation. Perhaps the word "essential" which I have just used, is not correct, for all the mineral matters found in a plant must be essential to its existence and to its growth; but some of these minerals exist, generally speaking, in soils, and that in sufficient quantities for the wholesome growth of the plant; others are in minute quantities, and they are soon removed by successive crops, and if the mineral elements which compose that soil, cannot by their decay or chemical decomposition set free, or bring into fit condition for the coming crop, these peculiar, rare, and still essential elements of vegetation, the soil will not reproduce the crops which require for their production those peculiar mineral substances. For example, a sufficient quantity of phosphates for turnips, or a sufficient quantity of potash for mangolds, or a sufficient quantity of silicates and phosphates for wheat and other graminous plants. It, therefore, becomes necessary that I should dwell for a few minutes on some of the most important mineral substances that should exist in the soil for peculiar crops, or should be added to it as a manure if that soil is not exhausted of those treasures of vegetation.

The first substance belonging to this class to which I desire to draw your attention is phosphorus. It is only within the last fifteen or twenty years that the importance of phosphorus to vegetation has been demonstrated. Although experience had led certain farmers to the knowledge that phosphates—for example, ground bones—would promote the growth of meadow lands, still the honour is due to Liebig not only of having pointed out but proved the importance of phosphorus, or rather of phosphates, as essential elements of the rapid growth of plants, and especially of roots, for he was the first to call the attention of the agricultural world to the benefits to be derived, if, instead of using phosphate of lime in its insoluble state as it exists in bones,* it was added to soils either in a soluble condition, or in one which might easily become so under the influence of certain agents to which I shall hereafter refer. It is since the publication of his ideas that we have had the researches of Boussingault, Lawes, Dr. Gilbert, Dr. Voelcker, and Ville, who have shown on the one hand the importance of phosphates to vegetation, and on the other the extremely small quantities which exist naturally in soils; for chemists have been able to discover only traces of phosphoric acid in ordinarily cultivated soils, and these minute quantities had been traced as existing in primitive rocks forming those soils; and, although I am quite ready to admit that agricultural chemistry is still in its infancy, and can at the present time give only here and there useful information to the farmer, or insights into certain phenomena which take place in agriculture, still it cannot be denied that when we consider that it is only within the last twenty or thirty years that chemistry has really attempted to unravel the mysteries attending vegetation, and also to give a clear and scientific explanation of facts which hundreds of years have revealed to man, we cannot deny that in pursuing the same course for a hundred years, most invaluable and enlightened information will be thrown upon agriculture, and instead of being the result of mere experience, which often leads to failures, the farmer will base his operations on sound and scientific principles, which will enable him to obtain from his land the full yield it is capable of producing. The best proof of the correctness of this statement is that in England, where chemical agriculture has made the greatest advance, farmers as a rule have ceased to allow the land to lie fallow—an operation which had for its object to allow the atmosphere to act upon the mineral elements of the land, so as to modify them in such a way as to liberate some of the scarce and still essential elements of vegetation, such as potash and phosphoric acid. In fact, so true is the rapid removal of phosphoric acid from what we call fertile land and its importance to the successful rotation of crops now adopted by most of the intelligent farmers of this country, that not only are bones imported from Australia, South America, and the Continent, but even minerals, such as apitite, are imported from Norway, and phosphorite from Estremadura, in Spain, and also under the form of semi-fossilized guano, under the names of Lambrero and Kooria Mooria guanos. But even these abundant sources of phosphoric acid do not appear to be sufficient to supply the large demand that there is at the present day for phosphates or super-phosphates for agricultural purposes, for large quantities of fossilized coprolites abundantly found in Cambridgeshire, Suffolk, and Bedfordshire are used especially under the name of superphosphate of lime. As to the mode in which they are treated to produce the valuable agricultural manure (superphosphate of lime) I must refer you to the first lecture which I had the honour to deliver before you last year, in which also you will find the proportions of such superphosphates of lime, the average composition of which I shall take the liberty of repeating here:—

Soluble phosphate	22	to	25	per cent.
Insoluble "	8	"	10	"
Water	10	"	12	"
Sulphate of lime	35	"	45	"
Organic matter	12	"	15	"

Nitrogen 0·75 to 1·5 per cent.

Although super-phosphate of lime is a soluble salt when added by the farmer on the surface of his land either dissolved in water or in the state of a powder, still this solubility must rapidly disappear when in contact with the soil, for the soluble phosphate of lime is due to the excess of phosphoric acid which it contains, and the excess disappears when in contact with the soil as it meets, generally speaking, carbonate of lime or of magnesia, or oxide of iron which neutralise the excess of acid, rendering thereby the remaining portions of phosphate of lime insoluble. It, therefore, becomes interesting to inquire how an insoluble substance becomes soluble to render it fit to be absorbed by the spongioles or the roots of plants so as to convey it into the plants themselves. This is effected by carbonic acid gas dissolved in water which penetrates into soils, or by the fumic acid discovered in soils by Thenard, or by a non-neutral substance, similar in its composition to sugar, which has also the power of rendering soluble the insoluble phosphates existing naturally in the soil or added to it by the hand of man.

Dr. Voelcker published in 1863, in the Memoirs of the Royal Agricultural Society, a most valuable paper on the absorption of phosphate of lime and phosphatic manures by root crops. Among the many facts which had a direct interest for those employed in the cultivation of the soil, there is one point connected with these researches to which I desire to call your attention, and that is the relative amount of phosphoric acid which is required by an average crop of wheat or of turnips per acre. You may observe in reading over the following table that whilst turnips require 39¾lbs. of phosphoric acid, wheat, which is considered a highly nitrogenated crop, only contains 25¾lbs. of the same substance. This statement is correct so long as you take the total weight of the crop produced by an acre of land, for one acre of land will produce 20 tons of turnips and about two tons of wheat; but if you take 100lbs. of each of these substances, then, of course, wheat will contain a far larger proportion of phosphoric acid than the turnips:—

* The general composition of bones may be considered to be as follows:—

BONES.

Organic Substances.	Blood-vessels...	1
	Osseine	32
	Fatty matters	9
Mineral Substances.	Water...	8
	Phosphate of lime	38
	Phosphate of magnesia	2
	Carbonate of lime	8
	Divers salts	2
		100

One Acre of Land.

	20 Tons of Turnips.		Wheat.	
	Bulbs.	Tops.	Grain. 1,920 lbs.	Straw. 3,840 lbs.
	lbs.	lbs.	lbs.	lbs.
Potash	132·	45·5	9·75	25·
Soda	6·25	7·	—	—
Magnesia	6·25	2·25	3·75	3·75
Lime	36·	68·5	1·	10·5
Phosphoric acid	28·25	11·5	16·25	9·5
Sulphuric acid	36·	25·	·25	5·25
Silica	3·	2·25	1·	128·75
Chloride of sodium	19·	18·25	·5	9·25
Chloride of potassium	—	11·5		
Carbonic acid	47·25	36·25	—	—
	314·00	228·00	32·5	192·00

The researches of Mr. Lawes and Dr. Gilbert have demonstrated thoroughly the truth that the employment of super-phosphate of lime as a manure is useful for promoting the growth of wheat, and is essential to the perfect success of a crop of turnips. M. Ville has also published important papers in the "Comptes Rendus of the Academy in Paris," on "The influence of phosphates on vegetation;" and the following table will, I hope, convince you of the marked influence which they exercise on vegetation:—

Influence of Phosphates on Vegetation.

Phosphate of lime, Alkaline silicates	20·86
Phosphate of lime	18·80
Earths and alkaline silicates	0·60
Earths	1·84

But the most interesting data at which M. Ville has arrived consist in that the presence of phosphates in soils determines a corresponding absorption of nitrogenated compounds by the plant; that is to say, that if phosphates are supplied to a vegetable, its growth will be partial; and if, on the other hand, ammoniacal salts or nitrates are supplied to it the growth will be imperfect; but if both of them be added to the soil, the absorption of the phosphate will be increased as well as that of the ammonia. This result is most interesting, not only in an agricultural point of view, but also as a physiological fact, for, until this important observation of M. Ville, scientific men had merely studied the immediate influence or absorption which the substance had on the vegetable or animal, without taking into account how these phenomena might be modified by the presence of others. I look upon the observation of M. Ville as one which will ultimately be far more appreciated than it appears to have been, and one which will lead to most important results in animal physiology and agriculture. I shall conclude these observations by giving you a table published by M. Ville, and which clearly sets forth the truth of these remarks:—

Amount of Nitrogen fixed by Wheat under the Influence of the following Salts:—

	Without Nitrogenated compounds.	With Nitrogenated compounds.
Phosphate of Lime and Alkaline Silicate	8·15	20·08
Phosphate of Lime	7·25	19·17
Earths and Alkaline Silicates	5·71	11·16
Earth	3·00	9·50

The extraordinary liberality with which the Emperor of the French has supported and encouraged all scientific researches or inventions which might tend to promote the welfare of his subjects, is exemplified in the case of M. Ville, for the Emperor has not only built a special laboratory for his use, and placed a large greenhouse and other means of investigation at his disposal, but has also allowed him to experiment on one of his private farms. And this encouragement has not been lost, for M. Ville has arrived at some very valuable and practical results. Admitting that he wishes to ascertain what the soil is deficient in, so as to produce a full crop, he divides, say an acre of land into four parts—adds to one portion superphosphate of lime; to another portion carbonate of potash; to another portion caustic lime; and lastly, nitrate of soda. He then places on these sections of the acre the various crops which are intended to be grown, and he soon finds out which of the four manures should be added to convert an ordinary yielding field into an abundant one. This simple and practical mode of proceeding has led him to use, as a general manure, which he calls mineral manure, the following substances:—Phosphate of lime, 4 parts; carbonate of potash, 4 parts; caustic lime, 1·5 parts; and nitrate of soda, 6·5 parts. The results have been most satisfactory, and among the many he has published during the last two or three years I shall simply give the following:—

Total Corn per Acre.

Unmanured	990	926
Mixed mineral manure	1192	987
Ammonia salts	1471	1618
Mixed mineral manures and Ammonia salts	2407	2295

Straw and Chaff per Acre.

Unmanured	1625	1459
Mixed mineral manure	1804	1528
Ammonia salts	2536	2705
Mixed mineral manure and Ammonia salts	4176	4016

Allow me to pass from these highly-interesting and practical results obtained by M. Ville to those not less valuable published by Dr. Voelcker on another mineral matter which, like phosphoric acid, is only found in small quantities as a natural product in soils, and which, if absent, like phosphoric acid, renders the soil unprofitable to the farmer. That substance is potash. Dr. Voelcker has not only studied the action of one compound of potassium, say the caustic or carbonate of potash, but he has examined the action of these and also of sulphate of potash, chloride of potassium, and nitrate of potash, and to enable him to arrive at the correct result he had compared the action of these different salts of potash on various classes of soils, namely, calcareous stiff clay, fertile sandy loam, pasture land, marly soil, and sterile sand; and he has come to the general conclusion that when salts of potash are added to these soils, although the quantity retained by them varies with the nature of the compound of potassium used or the nature of the soil operated upon, still the soil will retain the potash and not allow it to pass off in the water which may issue from it by drainage or otherwise. If he employs a salt of potash, say the nitrate, sulphate, or chloride, the sulphuric acid, the nitric acid, or the chlorine will combine with the lime or the magnesia, and even in some instances with the ammonia which the soil may contain, while the potash will substitute itself to either of these bases which were in the silicate, demonstrated to exist in soils by Professor Way.

As mankind increase on the surface of the globe, and their wants proportionately become greater, so by a marvellous and admirable dispensation of Providence, the power of the production of the soil to meet the wants of man is developed. A striking instance of this is given in the application of chemical discoveries to the cultivation of the land to make it commensurate with the growing requirements of the people. Thus, for example, we find stored in various parts of England—Suffolk, Cambridgeshire, and Bedfordshire—large beds of coprolites, or the

refuse of antediluvian animals buried there for thousands of years, unknown to man, and its value unappreciated. Further, chemists have discovered in Norway mountains of phosphate, under the form of apitite, and tracts of land of phosphorite in Estremadura in Spain. The same remarks applies with equal force and truth to salts of potash. Their supply up to the present time has been limited, as I stated to you in my last lecture, in speaking of the discoveries of M. Ballard, whose name I mentioned with no undue praise, as showing the benefits which society may derive from the extraction of a double chloride of potassium and magnesium from the ocean. Strange to say, within the last few years this identical salt has been discovered in large quantities as a mineral at Stassfurth, in Saxony, and although this mineral exists as a stratum under beds of ordinary common salt, and its discovery dates only three years back, there are at the present time 14,000 men employed in the factories which have risen on the spot for the extraction of the salt from its mineral, and its conversion into the various products required by the trade. This mineral, which has been called carnallit, and which assumes a thickness of 1,000, is composed in 100 parts, as follows:— Chloride of magnesium, 31·46; chloride of potassum, 24·24; chloride of sodium, 5·10; chloride of calcium, 2·62; salt of lime, 0.84; oxide of iron, 0.14; and water, 35·37. It may be considered as a definite chemical compound of 1 equivalent of chloride of potassium; 2 equivalents of chloride of magnesium; and 12 of water. I have not the slightest doubt that when this important discovery becomes generally known to our salt manufacturers, they will also turn their attention to the nature of the minerals composing the sub-soils of their salt beds, and will discover cannallit, and thus confer on the country a great boon by promoting its agriculture. The popularising of this fact may confer a great benefit on those salt-mine proprietors who are working their mines for rock salt, and who have not filled their mines with water, so as to take from them a brine containing the salt they require. I have no doubt that if cannallit is discovered in England, it will in many instances modify entirely the present method of working salt mines.

Lime.—Too much importance cannot be attached to the presence in certain proportions of lime in soils, for it is one of the essential elements of ashes of plants, and is necessary to their growth. In fact, Dr. Voelcker says:—

"We know practically how essential the presence of lime is for the healthy growth of every kind of cultivated produce. On soils very deficient in lime, most crops, especially green crops, are subject to all kinds of disease; and, consequently, roots fail altogether on such land, even if it has been liberally manured with good yard dung or guano. Up to a certain stage, corn and roots grown under such conditions appear to thrive well, but as the season advances they sustain a check, and at harvest time yield a miserable return. The remedy for such failures, which are not at all uncommon in localities where poor sandy soils prevail, is a good dose of lime or marl, and then, and only then, farmyard manure or guano may be applied to the greatest advantage. Marl or lime alone does not suffice for meeting all the requirements of our cultivated crops on such poor sands, and though calcareous minerals supply a most necessary element of plant-food, and by acting on the latent stores of food in the soil, produce at first a most strikingly favourable effect upon vegetation, they soon fail to produce the desired effect if repeated too often, to the exclusion of other fertilising matters. On the other hand, the most liberal application of farmyard manure of the best quality never produces so beneficial and lasting an effect on poor sandy soils as when they have been previously well marled or limed. On such land no doubt the proverb holds good:

"Lime and marl without manure
Only make the farmer poor."

"But at the same time I have a strong impression that on such land manure, without lime or marl, does not help much towards paying the rent. There are some soils which swallow up manure, with, so to speak, an insatiable appetite, without ever feeling the better for the manure; they are appropriately called very hungry. On all such soils I have no hesitation in saying much manure is wasted, or the most is not made of it, if previously to the application of farmyard-manure, guano, &c., the land has not received a good dose of marl or lime.

"My recent filtration experiments point out the reason why marl or lime is peculiarly valuable on poor sands. It is not merely by supplying in a direct manner a deficient element of nutrition that lime acts so beneficially on such soils, but because it preserves in the soil the more valuable fertilizing matters, which, like salts of potash or ammonia, rapidly filter through sandy soils, unless a sufficient quantity of marl or lime has been previously applied to the land. By these means the bases of the more valuable saline soluble constituents of rotten dung or of guano are retained in the soil, whilst the acids filter through it in combination with lime, a constituent which is, comparatively speaking, inexpensive."

The evening is too far spent for me to attempt to enter into the valuable researches of Mr. Lawes and Dr. Gilbert connected with meadow lands and the feeding of cattle; but I would strongly recommend those who take an interest in these branches of science to consult the papers published by those gentlemen in the *Journal of the Royal Agricultural Society.* I would also call your attention to a paper on the same subject by Mr. John Coleman, as well as a talented lecture which that gentleman delivered a few weeks since before this Society, in which he gives most important information to the farmer respecting the cheap feeding of cattle.

I hope, ladies and gentlemen, that you are now convinced of the truth of the assertion which I made at the beginning of this lecture, that no country possesses men better informed than those who exist in England on scientific agriculture. In fact, we can boast, especially if we give the lead to Scotch farmers, of being the leading nation in point of agricultural progress.

Lecture V.

Delivered on Tuesday, the 9th May, 1865.

On the Discoveries in the Chemistry of Rocks and Minerals.

Although the title of this lecture appears to have some reference to the lectures recently delivered by my learned predecessor, Professor Ansted, still the study of geology and mineralogy is so vast that different men may lecture on them without interfering with one another's views, or in the slightest degree with the special branch of that science that each one has chosen for his discourse.

The first subject to which I should wish to draw your attention is the origin of colour in minerals. Up to a very recent period it was generally believed that their colour was due to a minute quantity of certain metallic oxides diffused through the mass; thus the red colour of the garnet was attributed to sesquioxide of iron; ultramarine to oxide of cobalt; emerald to sesquioxide of chromium; and amethyst to oxide of manganese.

The first researches which were published, according to my knowledge, on the fact that organic matters might exist in minerals, are due to Sir David Brewster, who discovered in one of the most compact and hard minerals known, viz., topaz, exceedingly volatile hydrocarbons, which were so volatile that the simple heat of the hand, when brought to bear upon this mineral, proved sufficient to transform them into gaseous matters, which would recondense on the hand being removed. Sir David Brewster ascertained that the fluids were confined in small apertures, or cells, existing in the mineral, and calculated there were 3,000 cavities in one-seventh of an inch of topaz. In 1857 Lewy ascertained that the green colour of

the emeralds of Muso, New Grenada, was not due to sesquioxide of chromium but to an organic substance, for not only did they yield water and carbonic acid when heated in a close vessel, but on calcining a small quantity of the mineral it became colourless, and did not again resume its primitive colour, which probably would have been the case if the colour of the mineral had been due to sesquioxide of chromium. Notwithstanding this, Mitscherlich and Rosé published, in 1864, a paper in which they showed that the colour of a certain class of emeralds was due in their opinion to the presence of this oxide.

Knox also demonstrated the fact that smoked quartz became colourless when heated; and Kühlmann, in researches recently published, has shown that smoked quartz will lose its colour under the influence of heat, and that the blueish black colour of flint may be traced to the same cause.

Wolf proved some time since that the various colours which fluor-spar assumes are also due to organic substances; and his researches leave no doubt that the colour of green fluor-spar can be traced to a hydrocarbon. But one of the most interesting papers published of late on this subject is that of Professor Fournet, of Lyons, in which he shows that the reddish, yellowish, or greenish colour which some clays assume is not due, as was formerly believed, to metallic oxides, but may clearly be traced, in many instances, to the presence of organic substances.

Amongst numerous instances that he cites in his memoirs, the most curious one is the molecular change of certain clays into a mineral called jasper, "a double silicate of alumina and protoxide of iron," and which conversion could not be attributed to the action of heat, but to the slow dehydration of the clay and to pressure, for he was able to trace in those splendid veins of jasper existing in the province of Constantine, Algeria, the gradual passage of certain beds of clay into corresponding ones of jasper, and this mineral as well as the clay from which it was produced, became not only colourless under the influence of heat, but gave off vapours which had a strong empyreumatic or organic odour. Mr. F. Kuhlman, whose name I have often had the pleasure of citing in this course of lectures, has published of late in the Comptes Rendus of the Academy of Sciences of Paris, several papers on the interesting subject as to what the colouration of minerals is attributable to, and this gentleman has not only proved that in many instances the colouration of certain minerals and gems may be traced to the presence of organic matters, but he has succeeded in colouring certain colourless minerals; thus, for example, by plunging into melted pitch topaz, rock-crystal, and opal, and allowing a sufficient quantity of pitch to penetrate, he has given a yellow colour to the topaz and opal, and transformed white rock crystal into the smoky variety. This fact is not only interesting to a geologist, but must prove so to every reflecting mind, for it is difficult to conceive how substances so hard and compact can prove sufficiently porous to admit the vapours of volatile bodies. His researches have also for chemists a marked interest, for he has made the following curious observation, viz., that if he took plaster of Paris, mixed with a sufficient proportion of water to convert it into a solid mass (the composition of which is equal to $S\,O_3\ Ca\,O + 2\ HO$, or sulphate of lime, with two equivalents of water), and plunged it into a bath of melted pitch, the two equivalents of water would be replaced by an equal weight of pitch, converting the whole into a solid mass susceptible of taking a high polish, and therefore applicable to many ornamental purposes. He also proposes what I believe has been in practice now in England for some time, viz., dipping bricks, and other building materials, into melted pitch, and cementing them with that substance in all cases where an impermeable wall or surface is required.

Without entering into the numerous applications of Mr. Kuhlmann's researches, I cannot part with them without citing a simple method which he proposes to determine whether the colouration of a mineral or a gem is due to an organic or to an inorganic substance. To effect this he places a small quantity of the mineral in a small platinum tube, and passes over it hydrofluoric acid, which does not affect the colour of the gem if it is due to an organic substance, for example, those of the amethyst, ruby, black diamond, or yellow quartz, but discolours at once cornelian stones, their colouring substance being sesquioxide of iron, or a silicate of it.

Allow me to mention a most interesting, and as yet little known, class of minerals, the composition of which is not only interesting to chemists but also to astronomers, mineralogists, and natural philosophers; I mean aerolites. Notwithstanding the careful analyses that have been made of these meteoric stones, the presence of no new metal has been discovered in them, or of any which chemists have not found upon our own planet; but they have been able to ascertain that some of these aerolites contain, or are composed in some instances of, metals in a native state, which are never found in that condition upon our planet; thus it has been proved that some of them contain metallic nickel, cobalt, and even iron; in fact, in some instances, the volume of some of these aerolites that have fallen on our planet, which are composed of iron, has been sufficient to allow man to work them directly into implements; such was the case with an aerolite found in Mexico, which had the following composition:—

Iron	96·50
Nickel	3·50
	100·00

What in a scientific point of view enhances the value of this peculiar class of meteoric stones, is the presence in some of them of a peculiar yellow mineral, having a great resemblance to pyrites, but still differing entirely from it in composition, as proved by the analysis of Mr. Lawrence Smyth, who found it to be composed of four equivalents of iron, two equivalents of nickel, and one equivalent of phosphorus, and to it he gave the name of "schreebersite." It has lately been artificially produced by Mr. Faye, under the able guidance of Henry St. Claire Deville, by melting together in a crucible a mixture of oxides of iron and nickel, phosphate of soda, silica, and charcoal, allowing the whole to cool, when in the fused mass were found well-defined crystals, having a yellow colour, and identical in composition to the "schreebersite" analysed by Mr. Lawrence Smyth—a triumph of science, for it is the first example of the artificial production of a mineral substance found in an aerolite. The presence of a large proportion of metallic iron, and especially of phosphorus, in this class of aerolites, proves that they must have a cosmical origin, and that they must have been formed, or rather the mass from which they have been detached, must have been produced and existed where there was no atmosphere similar to that which surrounds our planet, viz., one containing oxygen. What tends to confirm this view is that many of the meteoric stones analysed by chemists contain a large quantity of carbonaceous matters. The most complete analysis of this class of meteoric stones is that made by Mr. Cloez of one which fell in June, 1864, at Orgueil, in the south of France, and which drew the attention of many scientific men at the time, owing to its fall being clearly traced, and specimens carefully secured; it had the following composition:—

Composition of the Orgueil Aerolite.

Hygrometric water	5·975
Silicic acid	24·475
Sulphuric acid	2·195
Sulphur	4·369
Chlorine	0·073
Phosphorus	traces.
Alumina	1·175

Oxide of chromium	0·025
Peroxide of iron	13·324
Protoxide of iron	17·924
Oxide of nickel	2·450
Oxide of cobalt	0·085
Oxide of manganese	1·805
Magnesia	8·163
Lime	2·183
Soda	1·244
Potash	0·307
Ammonia	0·098
Humin	6·027
Combined water	7·345
	96·442

This analysis of Mr. Cloez is not only interesting as showing the numerous substances which enter into the composition of one of these meteoric stones, but especially owing to the fact that he demonstrated in it the presence of an organic substance similar to coal, and also water. Chemists have also ascertained that many meteoric stones are highly siliceous, or composed almost entirely of silica or silicates of various metals. Mr. Charles Sorby, of the Royal Society, has recently published, in the *Proceedings* of that Society, some interesting papers on the microscopic differences which exist between the general texture or appearance presented by meteoric stones and the lava of volcanoes; also between the native meteoric iron and the commercial kinds. There can be no doubt that these researches will throw much light on the circumstances that have attended the formation of aerolites in general. At all events there can be no doubt that fire-balls, falling stars, and meteoric stones have a cosmical origin, and that they fall on the surface of our planet whenever they come within the earth's attraction, or that this force overpowers that of the sun. It is easy to explain, knowing, as we now do, their composition, why they appear luminous when they arrive near the earth's surface, for they have to traverse an oxidising atmosphere, or one containing oxygen, and as they travel through the space heat is generated by the friction of the particles composing them with those of the atmosphere, and the heat thus produced becomes sufficient for the combustible matters which enter into their composition, viz., carbon, iron, nickel, &c., being burnt or oxidised by the oxygen of the atmosphere. It is the knowledge of this fact which, no doubt, has suggested to Professor William Thomson his theory—that the high temperature of the sun is due to, and maintained by, the heat generated by cosmical matter falling on its surface, as I had the pleasure of explaining to you more fully in my first lecture.

I shall now examine with you the artificial formation of certain minerals and gems. Some of the earliest and most successful attempts in this line of researches are those of that talented chemist, Abelman, who made the curious observation that certain bodies or compounds, which chemists had considered as fixed or non-volatile, were susceptible of being volatilized if they were kept at a very high temperature for a long period, and also that bodies might be made to combine together and form certain minerals which existed already in nature. The fusible and volatile substance which he especially used was boracic acid; thus he mixed with a large quantity of this substance small amounts, but in equivalent proportions, of alumina and magnesia, and introduced the whole into a crucible which was placed in a porcelain kiln, and submitted to an intense heat for several days, when the greatest part of the boracic acid was volatilized; on allowing the fused mass to cool, well-defined crystals were found which, on examination, proved to be identical with the mineral called spinelle ruby, and by substituting the earth called glucina for magnesia, he obtained another gem called "cymosplane." Without adverting to the various mimerals and gems that he produced, I may state that his researches attracted much attention at the time they were published.

M. Daubray has also succeeded in producing artificially various minerals by submitting, in a boiler containing water, divers amorphous mineral matters to an extremely high pressure, and consequently to a comparatively elevated temperature, thus converting them into crystalline ones. By this means he succeeded in producing, among other minerals, crystallised quartz.

But certainly the most interesting papers that have been published in this line of investigation are those due to a gentleman whose name I have often cited in these lectures, I mean Henry St. Claire Deville. This gentleman has succeeded in converting amorphous bodies into well-known crystalline minerals by submitting them to the influence of minute quantities of another substance, under circumstances quite novel in themselves; and what enhances the value of his researches is, that the methods he has employed are similar to those which must have taken place in nature, and also the fact that the substance which he has employed to effect the change of an amorphous substance into a crystalline one, does not itself undergo any molecular change or decomposition. For example, he has transformed the red, amorphous, sesquioxide of iron into the crystalline variety called "oligiste iron ore," identical with that found in the Isle of Elba, or into specular iron ore, similar to that observed in the craters of volcanoes. To obtain these results he places the sesquioxide of iron in a porcelain tube, and whilst the whole is heated to dull redness, he passes over it a slow current of hydrochloric acid gas. This result explains how specular iron is found in volcanoes, for his brother and Dr. Daubeny have proved the existence of hydrochloric acid among the gaseous products escaping from these great natural furnaces, in which violent chemical reactions take place. Mr. H. Deville has also succeeded in converting a mixture of sesquioxide of iron and magnesia by means of a small quantity of hydrochloric acid or what he calls his "mineralisator," into a substance called "periclase," also found on Mount Vesuvius. These results are certainly extraordinary in a chemical point of view, if we remember with what facility these oxides dissolve in hydrochloric acid when brought into contact with an excess of that gas, even when operating under the circumstances in which he did, or when these oxides are placed in contact with a solution of the same acid. Mr. H. Deville also succeeded in producing "Haussmannite," or the crystallized sesquioxide of manganese, by substituting this oxide for sesquioxide of iron in the tube in which he operated. He further observed that if he employed binoxide of manganese instead of sesquioxide of manganese, he obtained, strange to say, beautiful green crystals of protoxide of manganese. But, certainly, the most important result arrived at was the artificial formation of a mineral called "staurotide," a silicate of alumina, a mineral that exists abundantly in nature. To effect this he introduced into a porcelain tube, placed vertically, first, a layer of alumina, then a layer of silica, over this a layer of alumina, and again a layer of silica, and so on until he filled his tube, ending with silica; he then applied a gentle heat to the tube, and passed through it a slow current of fluoride of silicon, which, on coming in contact with the alumina, gave rise to silicate of alumina, and fluoride of aluminium, which, in its turn, coming in contact with silica gave rise again to silicate of alumina and fluoride of silicon, and this chemical reaction continued from layer to layer until the whole mass in the tube was transformed into "staurotide," the same mineralising substance escaping from the tube as had entered it, although during its passage it had converted the amorphous alumina and silica into the well defined mineral called "staurotide."

Mr. Deville calls the attention of mineralogists as well as chemists to the probability that such similar actions have no doubt taken place in nature, and so gives an easy explanation of many of the facts observed by geologists.

In conclusion, I may state that Messrs. Deville and Daubray have succeeded by the same method in producing anatase, rutile, and brookite.

Mr. Kuhlmann has also published in the *Comptes Rendus* of the Academy of Science of Paris, several papers on the artificial formation of minerals, and although I drew your attention on several occasions to instances of their being produced under what he calls the crystallogenic force, in my first lecture, still I cannot refrain from adverting to another example, viz., that if gummy matter be mixed with syrup of sugar, and the whole dried rather rapidly, an amorphous varnish is left, say on the surface of a glass plate, but if then it is exposed to a damp atmosphere, after a few days, the whole of the surface becomes covered with well-defined crystals of sugar.

Mr. Faraday and Mr. Becquerel, sen., published, many years ago, some valuable papers, in which they showed that, by submitting proper metallic solutions to the influence of slow currents of electricity, slowly but surely, well defined mineralogical specimens would be produced, such as gypsum, pyrites, blende, galena, and several metallic oxides.

These researches present a peculiar interest when we consider the formation of the metallic veins or lodes on our planet, the more so that Mr. Becquerel employed moistened clay to separate the two different fluids in his tubes, as a substitute for porous cells in ordinary galvanic batteries, thereby imitating nature in many instances where metallic lodes are found; thus in Cornwall, often a clay slate called killas is found to accompany or to line the lodes of tin and copper, which no doubt fulfils, as in the experiments of Mr. Becquerel, the functions which a porous cell does in ordinary batteries.

That electricity must play an important part in the formation of metallic veins or lodes, there can be no doubt, if we reflect on the advantage taken by telegraphic engineers of the earth as a conducting medium for the return current of electricity, for, as you are aware, there is no necessity to employ more than one wire, since the earth completes the circuit, thus dispensing with the use of a second one, as it brings back the current to the instrument from which it has been emitted.

Further, many practical mining engineers have observed that the veins or lodes of tin and copper run or strike in Cornwall in an easterly and westerly direction, whilst those of lead, called "cross-courses," have a bearing nearly at right angles. I am aware that there are exceptions to this rule, but they are rare. A further proof that natural electricity must play an important part in the formation of veins or lodes, is that the largest deposits are generally found near the junction of two veins. Also that metallic veins are generally mixed with mineral matters differing entirely in composition from the rocks in which they are imbedded; this mixture of minerals bears in Cornwall the name of "gossan;" thus, for copper ores, the mixture is more or less rich in ochre, friable quartz, &c., and this "gossan" plays such an important part in the formation of veins, that it is the surest guide that a Cornish miner can have to direct him towards the mineral lode he is seeking for. In the case of copper, this "gossan" is generally above the lode; in tin, generally below, although often stream tin or peroxide of tin is found in the "gossan" itself. For lead ores in Cornwall, the gang is generally a soft blue or dark clay-slate, containing large quantities of alumina and carbonate of lime. In Derbyshire and other parts the gang is generally heavy spar or sulphate of baryta. As to gold, its matrix is quartz, and in North Wales nearly all the veins run in the same direction, viz., from east to west; whilst the iron veins, especially those which are magnetic, run from north to south, and in some instances exactly in the direction of the magnetic poles.

Allow me to draw your attention for a few minutes to a most important discovery which has been made within the last few months, by Bunsen, Edmond Becquerel, and Marcus, of an unforeseen adaptation of terrestrial electricity which results from a slight change of temperature between the various geological beds composing the crust of our planet, and which has received the name of thermo-electricity; up to this period it was admitted that all natural currents of electricity (or dynamic electricity) on the surface of our planet were due to chemical action or molecular changes which were constantly taking place between the various mineral matters composing its surface.

Before attempting to impress your minds with the important part which thermo-electricity must play in the production of the natural electrical currents of the earth, and therefore in the formation of metallic lodes or veins, as above stated, it is necessary that I should say a few words on thermo-electricity itself. If two metallic bars be so soldered together that they compose a closed circuit, a more or less intense current will be produced as often as the temperature varies at the places of junction, the current continuing as long as the difference of temperature is maintained, and this fact can be easily demonstrated if a bar of bismuth and one of copper be soldered together, and their other ends be connected with a copper wire made to pass over a suspended magnetised needle. As long as the temperature of the junction remains unchanged, no current is produced, but as soon as any slight change of temperature occurs at the point of junction, a current of electricity is produced, and the needle is deflected. All metals do not yield the same marked results as bismuth and copper, and investigations have shown that, as with dynamic electricity, metals have different degrees of conductibility; that some may be classed under the name of negative metals, whilst others may be ranged under the head of positive. As the quantity of electricity produced by this means is exceedingly feeble, Nobili conceived the idea of soldering together a number of thermo-electric pairs of copper and bismuth; thus composing a thermo-electric battery, or pile; and Melloni further multiplied the intensity of these currents by an instrument which he called a "thermo-multiplicator;" but, notwithstanding this the quantity of electricity produced by a change of temperature in this manner was so feeble that these currents were considered too insignificant to participate in any way in the production of the natural electricity which was known to exist.

In November last Professor Bunsen published in the "Annales de Poggendorf" a paper in which he showed that thermo-electricity was produced when blades of natural copper pyrites and of pyrolusite (a peroxide of manganese) were heated at their point of junction.

This publication induced Mr. Becquerel to publish a paper in the *Comptes Rendus* of the Academy of Sciences of Paris of last February, in which he showed that sulphur modified in a remarkable degree the thermo-electric power of metals; thus, that sulphide of bismuth was negative to bismuth itself; whilst proto-sulphide of copper was positive with respect to copper, and that the natural copper pyrites was negative to the same metal. Further, he showed that a thermo-electric pair, composed of a bar of copper, and one of protosulphide of copper, would produce, when heated between 32° and 212°, a current ten times as strong as that which would be produced by heating between the same temperatures equal surfaces of copper and bismuth soldered together, and that a more powerful pile still could be produced by forming a pair of proto and bi-sulphides of copper.

Without entering here into the numerous experiments and deductions which Edmond Becquerel draws from his researches, let me at once call your attention to some most valuable results obtained by S. Marcus, of Berlin, who has succeeded in constructing thermo-electrical batteries having a force far exceeding anything that could have been anticipated from thermo-electricity; thus he formed a battery of 25 elements capable of disengaging in a minute 25 cubic inches of hydrogen and oxygen, and of melting a platinum wire 1 millimetre in diameter when placed in the circuit. A battery of 30 elements produced a quantity of electricity sufficient to communicate to an electro-magnet the power of sustaining a weight of 150 lbs.

Mr. Marcus arrives at these results by soldering together long bars of metallic alloys, composed as follows:—

For the positive metal:—

Copper	10 parts
Zinc	6 „
Nickel	6 „

For the negative metal:—

Antimony	12 parts
Zinc	5 „
Bismuth	1 „

These alloys not only give rise to most powerful thermo-electric currents when soldered together, and their point of junction heated, but they are preferable to copper and bismuth, owing to the fact that they undergo no change at a comparatively high temperature as copper does, and do not melt like bismuth. Further, he increased in a marked manner the power of his battery by plunging one end of his soldered bars into cold water whilst their other end was heated by a gas flame, and as no solder could be found capable of resisting such a high temperature, the two bars composing the elements of his battery were united by means of screws.

These facts, together with some others which you will find published in the *Philosophical Magazine* of this year, must give you some idea of the enormous quantity of electricity that must be produced in the crust of our planet by means of thermo-electricity, for we all know the large amount of sulphurets of various metals that enter into the composition of that crust, and there can be no doubt, from the facts above stated, that the electricity so produced must and does contribute, in a marked degree, to the formation of veins and lodes.

My wish was to have drawn your attention to the variety of gases which escape from the craters of volcanoes when in activity, as well as from the secondary outlets, called "fumerolles," as much information has been added to our knowledge on these phenomena of late years by M. Charles St. Claire Deville and M. Fouqué since the valuable researches of Professor Daubeny on these phenomena; still, I cannot refrain from calling your attention to several tables which I have hung round this room, and which illustrate the great variety of gases that escape from the crater, as well as from the fumerolles which surround it. From the crater escapes hydrochloric and sulphurous acid, volatile chlorides, and aqueous vapour; at a short distance from it hydrochloric acid appears to cease, and sulphurous acid to predominate; thus in 100 parts of gas he found—

Sulphurous acid	24·5	
Oxygen	14·5	
Nitrogen	61·0	
		——100·0

At a further distance he found sulphuretted hydrogen and carbonic acid, varying from 0·8 per cent. to 28 per cent.; oxygen, 8·2 per cent.; and nitrogen, 90 per cent. In another case, 14·9 per cent. of oxygen, and 56·9 per cent. of nitrogen; and as he still proceeded further from the centre of activity, the sulphuretted hydrogen and sulphurous acid disappeared, and were replaced by carbonic acid, and lastly by a mixture of light carburetted hydrogen and carbonic acid, as this table illustrates:—

	Santa Venerina.	San Biagio.	Paterno.	Valice.	Girgenti.
Carbonic acid	3·13	74·99	95·35	93·49	1·65
Oxygen	1·18	2·78	0·58	0·68	0·69
Nitrogen	22·15	19·47	2·94	5·14	3·74
Carb. hydrogen ...	71·76	3·77	1·12	1·45	87·23
Hydrogen	3·70	0·99	0·50	0·43	5·74
Sulphuretted hydrogen	traces.	...	...	...	...

Proceedings of Institutions.

METROPOLITAN ADULT EDUCATION ASSOCIATION.—Evening classes for males and females have been organised in Holy Trinity Schools, Hoxton, under the presidency of the Rev. T. W. Fowle. A numerously attended public meeting was held on Oct. 31, in the school-rooms, when the class system and scheme of examinations promoted by the Association in connection with the Society of Arts were explained by the Rev. G. B. Macilwain, Hon. Sec., and Mr. H. H. Sales, Visiting Officer to the Society of Arts. There is good prospect of the newly formed classes forming the centre of other similar classes in the district.

Fine Arts.

HORACE VERNET'S TOMB.—M. Constant Dufeux has just completed the tomb of the painter, Horace Vernet, in *Pere la Chaise.* It consists of a large block of granite, without any ornament, upon which is placed a slab of white marble in the form of a Latin cross. The only emblems on the tomb are a drapery, studded with stars, which surmount the cross, and palette and brushes.

Commerce.

GREEN TEA.—Messrs. Travers give the following account of the production of this kind of tea:—"Some, perhaps, of our readers may not be aware of the fact that the tea shrub is a single species, and that from the same tree black or green tea might be made, indifferently; though for commercial purposes it has been found more convenient to confine the manufacture of particular teas to particular districts. The difference between the two, black and green, depends solely on the manipulation and the processes to which the leaves are subjected during the period of manufacture. In the case of the latter, those leaves which are intended to be converted into green teas are roasted almost immediately after they are gathered, and then quickly dried off after they have undergone the rolling process; the colour by this method becomes fixed, and there is no danger of any subsequent change. In the case of the black tea, the leaves are opened flat, and allowed to lie exposed for ten or twelve hours before being roasted; after roasting they are again exposed to the air in a soft and moist state, and finally they are dried slowly over charcoal fires. That this difference in colour is effected solely by the difference in manufacture is proved by subsequent observations made by Mr. Warrington at Apothecaries' Hall. Whilst engaged in the exsiccation of certain medicinal herbs, he found that the plants, but more especially those which were nitrogenous, brought from the country by the collectors, were on their first arrival of a bright green colour; but that when delayed too long on their journey, or confined for too long a period after being dried, they had entirely lost the bright green, and assumed a blackish-brown in its place. But it is not sufficient for the English consumer that the natural green only of the tea leaf should be there; the leaves before they are allowed to please the palate must pass the more exacting ordeal of the eye. They must be uniform in their appearance, and of a particular hue. As this effect can only be produced by the employment of colouring matter, a mixture compounded of gypsum and Prussian blue, is laid on the leaves, during the last process of roasting. This adulteration the Chinese do not hesitate to carry out on a systematic plan, and on a most extensive scale, and the practice, so far from diminishing, is even extending to the Northern parts of China. 'During this part of the operation,' says Mr. Fortune, in his description of the process, 'the hands of the workmen were quite blue. I could not help think-

ing that if any green tea drinkers had been present during the operation, their taste would have been corrected, and, I may be allowed to add, improved. It seems perfectly ridiculous that a civilised peeple should prefer these dyed teas to those of a natural green. No wonder that the Chinese consider the natives of the West to be a race of 'barbarians.'' Mr. Fortune says that half-a-pound of paint or colouring material is mixed with each hundred pounds of green tea. The Chinese readily acknowledge the superiority of green, uncoloured, but plead in excuse for their adulterations the wilful preference of the foreigner; we need hardly add that they are far too sensible to touch these dyed teas themselves."

Cotton.—From letters recently read before the Executive Committee of the Cotton Supply Association, it appears that the planting of the cotton seed has been attended with complete success in Jamaica, Tobago, Upolu (Samoa), and King William's Town (South Africa), but the most remarkable proof of the success attending the efforts of the society to promote the growth of cotton is to be found in the fact that, from the accidental reception of a handful of Sea Island cotton seed in the year 1863, between thirty and forty acres in the neighbourhood of Naples are now planted with it, from which a crop of about 40,000lbs. of seed-cotton, equivalent to a yield of 10,000 lbs. clean cotton, is expected this year. The handful of seed planted in 1863 produced about 80 lbs. of uncleaned; and with the seed of this quantity two acres and a-half were sown in 1864, which yielded a bale of 750 lbs. of clean cotton. At a time when New Orleans sold at 17d. per lb. and fair broach was worth 14d., this amount of Naples cotton realized as much as 29d. in Manchester. At Upolu, one of the Samoan group of islands, the Consul planted about seventy acres, and it was expected that there would be as many as 400 acres under cultivation before the close of the year. The whole of the Samoan islands are reported to be extremely suitable to the cultivation of cotton; but the implements in use there are of the rudest description, and the natives themselves are wanting in industry. Some New Orleans seed sent to Kurnaul, in the Madras Presidency, arrived too late in the season, so that the crop turned out a failure.

Colonies.

Hobart Town Statistics.—The estimated population of Tasmania on 31st December, 1864, was 93,307. The arrivals during the year are estimated at 3,711, and births 3,031; but from this must be deducted, departures 3,521, and deaths, 1,433—total, 4,954; leaving an increase on last year of 1,788. The births show a total increase of 33, and the deaths 15, on those of the previous year. The marriages registered were 698, precisely the same number as in 1863. During 1864, 118 immigrants were introduced—53 males and 65 females—the average cost to the colony per statute adult being £9 12s. 9d. Only 6 of the aboriginal inhabitants remain, 1 man and 5 women. They are located at Oyster Cove, and the cost of superintendence and maintenance last year was £522. The value of the imports and exports from Hobart Town was:—

	Imports.	Exports.
To United Kingdom	£252,590	.... £251,285
To British Colonies	296,425	 255,606
	£549,015	£506,891

The value of imports and exports from Launceston was:—

	Imports.	Exports.
From United Kingdom......	£95,696	.... £170,236
From British Colonies	263,554	 297,603
	£363,250	£467,839

During the past year 140,108 acres of country lots were sold by the Crown for £108,250, an average of 15s. 5½d. per acre. During the same period town and suburban allotments, comprising 1,273 acres, were sold for £7,546, being an average of £5 18s. 6d. per acre. The total number of acres in cultivation was 252,164, and 5,527 acres of new land were broken up during the year. Of this cultivated land, 60,186 acres were sown with wheat, yielding 839,501 bushels; 6,320 acres with barley, yielding 123,320 bushels; 40,987 acres with oats, yielding 995,382 bushels; 30,992 acres with colonial hay, yielding 35,210 tons; 127 acres with tobacco, yielding 242,778 lbs. 128,784 bushels of apples, and 13,840 bushels of pears, were grown last year, against 168,114 of the former and 25,800 of the latter the previous year. The present stock of live stock is:—Horses, 22,000; horned cattle, 89,801; sheep, 1,736,540; goats, 2,393; mules and asses, 13; pigs, 50,380.

Graving Dock for Melbourne.—The total length of this dock will 250 ft., and breadth 94 ft. at the top and 50 ft. at bottom. The depth will be sufficient to allow of the entrance of vessels drawing 25 ft. of water, which will render the dock available for vessels of the largest size that visit Hobson's Bay. The total cost is estimated at £100,000. A fair beginning has thus been made towards the dry dock accommodation which has for years been the great drawback to the Port of Melbourne, vessels of large size if wanted to be overhauled or repaired having to go to Sydney.

Telegraphing in New Zealand.—An order has been sent to England for a supply of thirty or forty miles of cable for connecting the northern and middle islands. The route had been surveyed by Mr. Balfour, and the cable would cost altogether £20,000—£10,000 for the first cost, and £10,000 bringing it out, laying down, and other incidental expenses.

Publications Issued.

The Life, Times, and Labours of the Marquis of Worcester, to which is added a reprint of the Century of Inventions. By Henry Dircks. (*Quaritch.*)—The origin of the steam-engine has never yet been satisfactorily elucidated. Many claimants have been put forth for the honour, and Mr. Dircks, in writing the life of the Marquis of Worcester, advocates his claims to be considered as the originator of that source of national power and wealth. Mr. Dircks has had placed at his disposal by the Duke of Beaufort, the present representative of the Marquis's family, a number of original manuscripts and documents not hitherto published.

Half-hours of French Translation. By Alphonse Mariette, M.A., Professor of the French Language and Literature at King's College, London. (*Williams and Norgate.*)—The first part of this work consists of a well-chosen series of extracts from good English writers, very various in style, and in the form of idiom employed. The range of selection is over the whole of the wide field of English prose, between the essays of Lord Bacon and those of contemporary journalists. The choice of each extract has been founded not upon its merit more than its convertibility into French. Every passage may be so translated that a good translation shall seem to contain not the words only but the thoughts also, and some one of the moods of a Frenchman. In foot-notes, carefully appended to each passage, the labour of the pupil is lightened by the supply of fragments of translation where the two languages differ in idiom. In the second part of the book, Professor Mariette has translated from contemporary French authors choice illustrations of the French of to-day, and has so translated them that they may by a skilful hand be faithfully turned into French. In the extracts from French writers there is the same regard paid to variety of tone; and the student who throughout the first part of the book is speaking the thoughts of his own land in the language of a neighbour, in the second part of

the book, when he does not mistranslate, is actually writing French thoughts in the Frenchman's way. A key to the above, by the same author, is also published.

Forthcoming Publications.

THE RECORD AND DESCRIPTIVE CATALOGUE OF THE DUBLIN INTERNATIONAL EXHIBITION OF 1865, by Henry Parkinson, Secretary and Comptroller; and P. L. Simmonds, Colonial Superintendent. (*Dublin, John Falconer.*) This work will contain all the official documents, statistical data, and descriptive information of the rise, progress, and results of the exhibition and winter garden building; with details of the articles exhibited, and the advance made in Irish industries since 1853, and is published under the sanction of the Executive Committee, and dedicated to His Grace the Duke of Leinster, B. L. Guinness, Esq., M.P., and Gilbert Sanders, Esq.

Notes.

READING INDUSTRIAL EXHIBITION.—The Industrial Exhibition, and collection of fine art treasures from the mansions of Berkshire, held at the Town-hall, Reading, since the 13th of September, closed on Monday, the 30th October, when the medals and money prizes were distributed by the Right Hon. the Earl of Carnarvon. The undertaking has been carried out with spirit, and been attended with great success, nearly 70,000 persons having visited the exhibition, and the receipts amounting to £1,800. It is estimated that the expenditure will amount to £1,300, of which sum £300 were set aside for money prizes, medals, and certificates.

MIDDLE-CLASS EDUCATION IN THE CITY.—A proposal has been made by the Rev. William Rogers, M.A., rector of St. Botolph, Bishopsgate, a member of the Council of the Society of Arts, for an extension of the means of education in the city of London, so as to meet the confessed wants of a great class there who are at present without any public provision of the kind. The educational wants of the poor are met by the ward and other schools; but above these is a large middle-class, composed of tradesmen and people employed in the City, who cannot well send their children to the Ward or National Schools, and who are debarred by various circumstances from availing themselves of the great city schools. The recipients of the endowed charities in city parishes are yearly diminishing in number, but the funds are increasing. It is proposed that a combination of the parishes should be brought about, and from such surplus funds a system of education should be established for the children of parents who cannot afford to pay more than say £1 per quarter for their education. The contributing parishes to be represented upon the board of management of the schools, and the children of parents who either reside or are employed in such parishes to have a prior claim of admission to the advantages. It is thought that Finsbury would be a convenient and desirable situation for a school of this nature.

MUSICAL EDUCATION IN PARIS.—The municipal authorities of Paris have this month established courses of gratuitous instruction in singing in the municipal schools of eighteen of the arrondisements of the city, one, two, or three courses in each, making in all twenty-eight classes; two arrondisements only are now without gratuitous vocal instruction.

IMPROVED RAILWAY ACCOMMODATION.—A novelty has been introduced in the railway between St. Petersburgh and Moscow; carriages, designated as *wagons hôtels*, containing a saloon, and also closets with comfortable beds, have been placed on the line by a speculator, who charges two roubles extra to each passenger who avails himself of the new carriages, in addition to the ordinary passenger fare charged by the company.

CONSUMPTION OF ALIMENTARY MATTERS IN FRANCE.—M. Payen, the well-known chemist, gives the following statistics, which are said to be authentic. France consumes annually, in round numbers, about 700,000,000 gallons of milk, of which Paris takes nearly one-third; nearly 120,000 tons of cheese of all kinds, the share of Paris being only 5,000 tons; 290,000 tons of sugar, Paris consuming 20,000 tons; nearly 38,000 tons of coffee, Paris using 4,500 tons; 20,000,000 gallons of beer, of which Paris drinks an entire sixth. The total quantity of wine produced in France is set down at nearly a thousand millions of gallons, and valued at twenty-two millions sterling, or about fivepence per gallon.

Correspondence.

PASSAGE ACROSS LA MANCHE.—SIR,—Can anything be more barbarous and cruel than the arrangements which at present the public tolerate for crossing the 22 miles of sea between France and England? On both sides of the channel the railways afford comfortable shelter in stations and carriages, with rugs, and carpets, and *chauffe-pieds;* but as soon as you leave the carriages at the termini you are sent adrift in hail, rain, snow, and cold on the steamer, and are much less cared for than your baggage. If the day be wet—and throughout more than six months of the year this is the case—your feet are soaked through in descending the well-watered steps from Dover-pier to the steamer or across the pavement at Calais. When you arrive on board you have the choice between the cabin, detestably close and stinking, filled with human beings senselessly prostrate and sick, or the open deck, with the certainty of being soaked through by the rain and the spray washing over the boat from the head of the vessel to the man at the wheel. There is no shelter whatever afforded by these little swift steamers, which rush through the water, and nothing can be had for covering except the stiff, rough, wet tarpaulin jackets of the sailors, which you don't get till you are already half-wetted through. It is persecuting enough to a hale man not given to sea-sickness, but to women and those who faint when descending to the cabin, the arrangements, or rather utter absence of arrangements, are cruel and excessively dangerous, especially for invalids. Can nothing be done in this age to ameliorate the sufferings of those dreadful two hours? To obtain a swift passage must, at least, an average of 200 persons every day in the year be thus persecuted? I don't believe it at all. It is not my province to suggest the remedies for obtaining shelter on the deck, which even the present boats might, I conceive, adopt. But here is a proposal, at least as a temporary palliative, until something better can be done. Let the railway companies offer to each passenger, at a proper charge, the use of a waterproof *capôte*, covering the head and shoulders, a long, warm, cloth-lined macintosh-cloak — say about 7ft. long—with a pair of waterproof over-boots, and an air cushion for sitting upon on the wet seats. They might be so made as effectually to keep the wearer dry from the rain and sea. They should be provided for the passenger either at starting or at the last station before crossing. If necessary, he might make a deposit for their value, which would be returned upon giving up the articles. It may be said every one can do this for himself. Certainly he could, and no doubt would if he had to cross frequently; but twice a year is as much as most travellers do, and they don't make special preparations. These articles would enable both women and men to stay on deck if they preferred it, and would prevent that soaking which afflicted my wife, two ladies, and your humble servant last week, entailing upon most of the parties colds and coughs which may chance to last all the winter, and largely increase the doctor's bill at Christmas. These

remarks apply equally to the passages to Ostend and elsewhere. The College of Physicians, the Institute of Civil Engineers, and the Society of Arts should all agitate respectively for some efficient remedies for the present state of things; and as Parliament descends to regulate London cabs, it might as well, perhaps, direct the Board of Trade to look to the small fry of sea steamers and their discomforts.—I am, Sir, yours, &c., Felix Summerly.

Oct. 26.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Medical, 8. General Meeting for Alteration and Revision of Laws. 1. Dr. Althaus, "On Degeneration of the Posterior Column of the Spinal Cord." 2. Mr. Leonard Clark, F.R.S., "On the same subject."

Tues. ...Ethnological, 8. 1. "Report on the Ethnological Papers read at the Meeting of the British Association in Birmingham." 2. Captain L. Wildman, R.N., "Notes on the Manners and Customs of the People about Little Popo, on Bight of Benin." 3, Dr. Cullin, "On the Darien Indians."

Wed. ...Geological, 8. 1. Mr. R. A. C. Godwin-Austen, F.R.S., "On the Submarine Forest-beds in Porlock Bay. 2. Rev. R. Boog Watson, "On the Marine Origin of the Parallel Roads of Glen Roy."

Patents.

From Commissioners of Patents Journal, October 27th.

Grants of Provisional Protection.

Aerated wafers—1774—W. S. Parfitt.
Air, obtaining motive power by expansion of—2600—W. E. Gedge.
Alarms, apparatus for sounding—1898—J. H. Wray.
Bedsteads, &c.—2656—J. L. Hancock.
Blast furnaces—2528—S. C. Salisbury.
Block matches—2690—J. W. Truman and H. Lovi.
Bolts, &c.—2618—F. P. Warren.
Boots and shoes, elastic fronts, &c., for—2640—M. Cartwright.
Breech-loading fire-arms, cartridges for—2542—J. and F. J. Jones.
Breech-loading guns, projectiles, and cartridges—2512—E. Lindner.
Calender bowls, and cylinders or rollers—2636—W. Mather.
Capstans—2576—W. D. Grimshaw.
Carbonic acid gas—2660—A. J. Mott.
Carding engines, grinding cards for—2518—S. Faulkner.
Carriages, wheels for—2668—J. L. Hancock.
Casks for oil—2500—J. H. Pinckvoss.
Cast iron and steel—2456—N. Korshunoff.
Cattle, food for—2514—R. Willacy.
Chair, reclining—2504—G. Davies.
Chairs, folding—2678—G. Davies.
Clod crushers and chain harrows—2634—W. C. Cambridge.
Clothes wringing machines—2336—T. D. Stetson.
Coating iron and steel with gold, &c.—2592—J. B. Thompson.
Copper—2662—W. Clark.
Cornices, &c., composition for forming—2638—W. Barwick.
Cotton seeds, cleaning—2554—J. C. Stovin.
Crucibles, &c., moulding—2464—R. A. Brooman.
Danger, telegraphs for indicating—2584—C, H. Mellor.
Doors, fasteners for—2566—C. F. Gerald.
Dyeing—2506—J. de Weweirne, jun., and A. Verschaffelt.
File-cutting machines—2548—J. Dodge.
Fire-escape—1666—W. E. Gedge.
Fire-proof floors and ceilings—2594—J. Homan.
Fire-proof floors for buildings—2578—J. Cunningham.
Flax, &c., machines for winding—2588—J. Kirby.
Folding chairs—2200—G. T. Bousfield.
Furnaces, consuming smoke in—2382—C. Worsam.
Gas—2620—J. Crutchett.
Gas meters—2372—W. Esson.
Grain, cisterns or chambers for steeping—2492—C. E. Davis.
Hides, tanning—2591—W. Harris.
Horses, shoeing—2496—W. E. Newton.
Hydro-carbon, casks for containing—2644—G. Marshall.
Iron—2448—W. Unwin.
Leather, &c., perforating—2556—E. Marsland and P. Williams.
Life-rafts—2510—J. W. Hurst.
Linen buttons—2066—W. Aston.
Liquids, evaporating and distilling—2590—T. Campbell.
Liquids, heating and cooling—2494—I. Smith and W. F. Batho.
Liquids, raising—2632—J. U. Bastier.
Locks and latches—2484—C. Price.
Lozenges, &c.—2534—C. J. Tinker.
Meat, treating and obtaining products from—2558—R. Morson.
Mechanical propelling screw toy—2572—L. A. I. Daumesnil.
Mill stones—2692—W. H. Parker.
Motive power, obtaining—2020—A. Sleigh.
Musical reed instruments—2541—F. Tolhausen.
Oil from coal, &c., extracting—2544—A. Craig.
Paper—2404—S. Trotman.
Pencils and pencil cases—2486—M. Nopitsch.
Photography, preparing paper, &c., for—2648—J. de W. Brinckerhoff.
Pianofortes—2540—E. Farr, W. Tarr, and I. Gregory.
Pianofortes—2562—B. Johnson.
Railway signals—2526—H. G. James.
Railway trains, signals for—2586—J. Hancock.
Railway wheels, tyres for—2654—W. J. Armitage, F. Wooler, and J. Hodgson.
Saddles—2688—T. Jones and E. K. Mason.
Saucepans, &c., sheet metal handles for—2228—J. Fallows.
Screws, cutting—2652—J. Tangye.
Serpents, &c., fire-work producing the forms of—2293—F. Tolhausen.
Sewing machines—2498—R. A. Brooman.
Sewing machines—2666—J. B. Robertson.
Sheet metals, fixing—2522—J. W. Tyler.
Ships' waterclosets—2546—E. W. de Rusett and R. F. Dale.
Ships, cleansing the bottoms of—2589—T. M. Gisborne.
Silk, &c., dyeing and printing—2536—R. A. Brooman.
Skates, fixing—2642—W. May.
Skins, hides, or leather, making waterproof—2516—J. W. M. Miller.
Specific gravities and the bulk of solids, ascertaining—2490—A. M. Bennett.
Spinning, bobbins used in—2368—J. K. Hoyt.
Steam boilers, tubular—2260—J. Lake.
Steam engines—2502—W. E. Gedge.
Steam, generating—2604—J. Sturgeon.
Steam generators—2610—J. H. Johnson.
Submarine lamps—2458—J. S. Staines.
Submarine telegraph cables—2530—H. A. Bonneville.
Submarine telegraphy—2612—J. F. Wiles.
Telegraphic cables, laying—2570—F. W. Gardiner.
Tompions for ordnance, and stoppers for bottles—2650—W. E. Newton.
Tooth-powder, receptacle for—2470—A. Farr.
Turning lathe, chucks for—2680—R. Burley.
Ventilating spring mattress—2511—J. E. Townshend.
Vessels, propelling—2418—R. Atkin.
Washing liquors—2582—J. Roddy.
Water, liquid compound for purifying—2646—R. A. Brooman.
Water, purifying and preserving—2674—C. G. Lenk.
Weaving, looms for—2395—J. Edmondson.
Weaving, looms for—2596—P. Todd.
Weaving, looms for—2672—E. Lord.
Weights, raising—2560—H. A. Dufrene.
Whistles, signalling by means of combined—2575—W. A. Martin.
Woollen fabrics, waterproofing—2568—H. F. Smith.
Yarns or threads, spinning, &c.—2538—W. E. Newton.

Invention with Complete Specification Filed.

Sliding surfaces, obtaining—2729—L. D. Girard.

Patents Sealed.

1197. L. W. Broadwell.
1198. T. White.
1203. W. Leatham.

From Commissioners of Patents Journal, October 31st.

Patents Sealed.

1208. H. Bessemer.
1210. C. E. Herpst.
1213. J. C. Davis.
1215. M. W. Ruthven.
1216. W. E. Wiley.
1224. R. Fenner.
1227. F. Wise
1229. F. Allcock.
1230. C. W. Siemens.
1231. J. Catillon.
1232. J. B. Lavanchy.
1234. E. T. Read and J. B. Fyfe.
1238. T. W. Roe.
1243. G. Josse.
1244. E. G. Smith.
1245. W. F. Stanley.
1247. G. Redrup.
1248. F. Caldwell.
1249. J. Hampton.
1250. W. Roberts.
1251. J. Lilley.
1252. A. Mackie, H. Garside, and J. Salmon.
1255. W. Henderson.
1257. T. J. Mayall.
1260. J. Mitchell.
1261. J. Wadsworth, H. Dussett, and J. McMurdo.
1262. J. McGlashan.
1287. W. Jackson.
1291. D. Adamson.
1300. J. J. Révy.
1303. S. Pokutynski and M. Mycielski.
1311. G. Mountford and E. Worroll.
1314. E. L. Girard.
1317. J. Hesford.
1390. C. Varley and S. A. Varley.
1440. H. E. Newton.
1466. W. Settle.
1514. W. E. Newton.
1544. J. Kennedy.
2285. J. Pilkington.

Patents on which the Stamp Duty of £50 has been Paid.

2863. A. J. F. Vigneulle-Brepson.
2894. A. Peck.
2963. J. Musgrave.
2880. T. G. Ghislin.
2891. J. J. Ridge.
2887. F. Lipscombe.
2890. F. L. H. W. Bunger.
2892. P. E. Placet.
2900. E. Tathum and A. Tatham.
2931. P. Giffard.
2946. G. Speight.
2908. A. Shanks and F. Kohn.
2922. F. L. Stott.
2927. F. Gregory.
2937. W. R. Bowditch.
2951. J. G. Marshall.

Patents on which the Stamp Duty of £100 has been Paid.

2409. W. Munro.
2406. A. Heywood.
2411. W. Hall and A. Wells.

THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111th Session.] FRIDAY, NOVEMBER 10, 1865. [No. 677. Vol. XIII.

TABLE OF CONTENTS.

Announcements by the Council.

NOTICE TO MEMBERS.

The One-Hundred-and-Twelfth Session of the Society will commence on Wednesday, the 15th inst., when the Opening Address will be delivered by Wm. Hawes, Esq., F.G.S., Chairman of the Council.

The following are the dates of the Wednesday evening meetings, the chair being taken at Eight o'clock:—

1865.	November	—	—	15	22	29
,,	December	6	13	20	—	
1866.	January	—	—	17	24	31
,,	February	7	14	21	28	
,,	March..........	7	14	21	—	
,,	April	4	11	18	25	
,,	May............	2	9	16	23	30
,,	June	—	—	—	27*	

For the Meetings previous to Christmas, the following arrangements have been made:—

November 15.—*Chairman's Opening Address.*

November 22.—"On Water Supply, especially in Rural Parishes and Districts." By J. Bailey Denton, Esq.

November 29.—"On the Proposed Purchase of Railways by the Government." By William Hawes, Esq., F.G.S.

December 6.—"On the Graphotype, a Process for producing from Drawings, Blocks for Surface Printing." By Henry Fitz-Cook, Esq.

December 13.—"On London Milk." By J. Chalmers Morton, Esq.

December 20.—"On Parkesine, its Composition, Manufacture, and Uses. By Owen Rowland, Esq.

The Cantor Lectures for the ensuing Session will consist of Three Courses, to be delivered by G. W. Hastings, Esq., LL.D., Barrister-at-law; Fleeming Jenkin, Esq., F.R.S.; and Dr. F. Crace Calvert, F.R.S.

* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

The following are the particulars of Mr. Hastings's course:—

Lecture I.—Monday, November 27th.—"The Effects of the Discovery of the Precious Metals on the Ancient Civilisation of the Mediterranean."

Lecture II.—Monday, December 4th.—"The Effects of the Discovery of the Precious Metals on Modern Civilisation.

Lecture III.—Monday, December 11th.—"On Copyright."

Lecture IV.—Monday, December 18th.—"On Limited Liability."

The lectures will commence each evening at Eight o'clock.

These Lectures are open to Members, each of whom has the privilege of introducing one Friend to each Lecture.

Proceedings of the Society.

MUSICAL EDUCATION COMMITTEE.

The following are the prospectuses of the three chief Private Academies of Music in the Metropolis:—

THE NATIONAL COLLEGE OF MUSIC.

Temporary Office, 216, *Piccadilly* (*two doors from the Regent-circus*).

The College is founded with the design of enabling ladies and gentlemen to obtain a complete professional education on the system of the Continental *Conservatoires*, and to encourage the study of music more generally throughout the United Kingdom.

Although the scale of fees is very moderate, the Council have the power of assisting those showing remarkable talent, by granting a lower scale of payment, by the establishment of scholarships, and even by gratuitous instruction under peculiar circumstances.

Classes for amateurs will be organised in connection with the College, as the Council desire to place it in the power of everyone to receive the best instruction at a moderate expense.

Council.—Sir Reginald Barnewell, Bart.; Henry Brougham, Esq.; Lord Douglas; Viscount Dunlo; Lord Elphinstone; Paul Graham, Esq.; Viscount Hamilton,

M.P.; Sir Henry A. Hoare, Bart.; the Hon. Greville Howard; Lord Schomberg Kerr; Capt. Le Patourel; Rev. Sir F. A. Gore Ouseley, Bart. (Mus. Prof. Oxon); J. St. Aubyn, Esq., M.P.; Harry W. Scott. Esq.; A. Nowell Sherson, Esq.; Captain Gerard Smith (Scots Fusilier Guards); Capt. the Hon Walter Trefusis; Rev. W. Crole Wyndham; and N. F. Zaba, Esq.

Treasurers.—The Marquis Townshend and the Hon. Seymour Egerton.

Trustees.—The Marquis Townshend, Lord Kingsale, and Rear-Admiral King, C.B.

Professors.—(Principal, Mr. Henry Leslie).—Composition—Mr. Benedict and Mr. Arthur Sulivan. Harmony—Mr. E. J. Hopkins and Mr. Franklin Tayler. Pianoforte—Mr. Benedict, Mr. Lindsay Sloper, Mr. Franklin Tayler, and Mr. J. G. Callcott. Singing—Mrs. Sims Reeves, Signor Pinsuti, Mr. Frank Mori, Mr. James Bennett, and Mr. Henry Regaldi. Violin—Herr Ludwig Strauss. Viola—Mr. Webb. Violoncello—Herr Daubert. Contra Basso—Mr. Howell. Flute—Mr. Sidney Pratten. Oboe—Mr. Alfred Nicholson. Clarionet—Mr. Lazarus. Bassoon—Mr. Waetzig. Horn—Mr. C. Harper. Trumpet and Cornet-à-Piston—Mr. Thomas Harper. Trombone—Mr. Winterbottom. Organ and Harmonium—Chevalier Lemmens. Concertina—Mr. J. C. Ward. Harp—Mr. Aptommas. Italian Language—Signor J. Pepoli. Declamation—Rev. W. W. Cazalet, M.A.

The students will be divided into two departments—ladies and gentlemen—and each department will be divided into two schools, "Upper and Lower." Fee for the "Upper" school, per term, £7; fee for the "Lower" school, per term, £5 5s.

Two scholarships (to be called the "Townshend" Scholarships) will be open to competition by all students of three terms; one of such scholarships to be given to the most deserving pupil in each school, who will thereby be entitled to a year's gratuitous instruction.

The half-yearly term will commence on Monday, February 20th; and Easter term on Monday, April 24th, 1865. Entrance fee, 5s.

LESSONS DURING EACH TERM.

For the Upper School:—

Pianofort—Eighteen lessons of half-an-hour, with class lessons in harmony.

Singing—Eighteen lessons of half-an-hour, with instruction on the pianoforte, in harmony, the Italian language, and English declamation.

Composition—Eighteen lessons of half-an-hour, and instruction on the pianoforte and stringed or wind instruments.

Stringed Instruments and Wind Instruments—Eighteen lessons of half-an-hour, and instruction on the pianoforte and harmony.

There will also be Orchestral Practice and Class Singing.

For the Lower School:—

The same amount of instruction will be given as for the Upper School, with the exception of the pianoforte, for which 24 lessons will be given in each term.

REGULATIONS FOR PROFESSIONAL STUDENTS.

All students will be obliged to learn Harmony, and must attend whatever extra classes the Professors may deem essential to their improvement, but no further charge will be made on that account.

Performances will be given, at which the students may be required to assist.

Students will not be allowed to perform in public without the consent of the Council.

No lady or gentleman will be allowed to advertise as having been educated in the College, without the certificated sanction of the Professors.

The year will be divided into three terms, viz.:—Lent Term, commencing early in January and ending at the end of March. Easter Term, commencing in April and ending early in July. Michaelmas Term, commencing in October and ending before Christmas.

THE AMATEUR CLASSES.

Classes for Amateurs will be held by Messrs. Benedict, Lindsay Sloper, and Ernst Pauer, for the Pianoforte; Monsieur Lemmens, for the Harmonium; Mrs. Sims Reeves, Mrs. G. A. Macfarren, Mr. Frank Mori, Signor Pinsuti, Signor Ciabatta, and Signor Mecatti, for Singing. Fee, for twelve lessons of half-an-hour each, £5 5s.

MR. G. A. MACFARREN'S CLASS FOR HARMONY AND COMPOSITION.

Fee for twelve class lessons of one hour each, £3 3s.

Classes for Amateurs will be also formed under the other Professors of the College.

The pupils of these classes will not be allowed to compete for the scholarships, which are intended exclusively for the professional pupils. By Order of the Council,

GEORGE LESLIE, *Secretary.*

261, Piccadilly.

THE LONDON ACADEMY OF MUSIC.

St. James's Hall, Piccadilly, W.

Principal, Professor Wylde, Mus. Doc.

Masters.—Harmony and Composition—Herr Molique. Pianoforte—Dr. Wylde and Mr. J. F. Barnett. Italian Singing—Signor Garcia, Signor Lablache, and Signor Schira. Singing—Signor Zamboni and Signor Gilardoni. Sight-Reading and Accompaniment—Herr Wilhelm Ganz. Harp—Herr Oberthur and Mr. T. H. Wright. Violin—Her Molique and Herr Jansa. Violoncello—M. Paque. Organ—Mr. George Cooper. Harmouy—Herr Engel. Concertina—Signor Giulio Regondi. Italian Language—Signor Maggioni.

Other Masters in various branches. A lady superintendent and governess.

This Academy (which is divided into two departments, one for ladies the other for gentlemen) is designed for vocal and instrumental students desirous of receiving a complete musical education in this country, from the best London professors, on the moderate fees of the Continental Institutions.

Students can select either Harmony, Pianoforte-playing, Singing, or any other branch of the Art, as their principal study, and receive individual instruction in that branch from one of the principal professors; they will, in addition, receive instruction in two other branches.

For example:—A student selecting Harmony and Composition as a pricipal study, is entitled to receive individual instruction from Herr Molique, and Pianoforte and elementary Singing lessons.

A student selecting Pianoforte-playing as a principal study, is entitled to receive individual instruction from Dr. Wylde and Mr. J. F. Barnett, elementary Singing lessons, and Harmony lessons in the Principal's Harmony Class.

A student selecting Italian Singing as a principal study, is entitled to receive individual instruction either from Signor Garcia, Signor Lablache, or Signor Schira, Pianoforte lessons from an assistant professor, and class Harmony lessons.

TERMS.

The year is divided into three terms, each term consisting of twelve weeks' instruction. A lesson is given once a week in each branch of study. The terms commence on January 12th, April 24th, and October 2nd. The Academy is closed for a mouth's vacation at Christmas, and for two months at the end of the London season.

Students residing at a distance can receive all their lessons on one day.

The fee for each student is five guineas per term, which includes the whole course of instruction necessary for a complete musical education. Italian and Elocution are extras. The fee for Italian is, fifteen shillings per

term of twelve weeks; for Elocution, fifteen shillings per term of ten weeks.

All fees are required to be paid in advance.

CANDIDATES FOR ADMISSION AS STUDENTS.

Candidates for admission as students must show that they possess sufficient ability to profit by the course of study, and are required to attend at the Academy before the commencement of the term at which they desire to be admitted, in order to be examined by the principal. The examination days can be known by referring to the advertisements in the *Times*. The examination-fee is five shillings, payable at the office, St. James's Hall, where prospectuses may be obtained.

A. AUSTIN, *Secretary.*

The competition for the scholarships took place in May last, Madame Schuman and Signor Arditi were umpires. Of the pianistes, Miss Fanny Baker and Miss Kate Roberts obtained an equal number of marks; of the vocalists, Miss Pratt obtained the highest number.

THE LONDON VOCAL ACADEMY.

18, *Cecil-street, Strand.*

Principal, Mr. Frederick Kingsbury.

Professors.—Cultivation of the Voice and Singing—By the Principal. Pianoforte and Accompaniment—Walter Bache, Esq. French Language—Mons. De Fontanier (author of "La Grammaire Simplifiée). Elocution—C. J. Plumpre, Esq. (Lecturer on Elocution, Oxford and London.

The Academy (divided into two departments, one for ladies and the other for gentlemen) has for its object complete education in all its branches of study necessary to the vocal artist, and is in this respect modelled upon the systems adopted by the Continental *Conservatoires.*

Instruction in the cultivation of the voice, and the formation of a finished style of singing, will be undertaken by the principal, from whom each student will receive separate personal tuition. The collateral studies, such as Pianoforte, Accompaniment, Harmony, Languages and Elocution (each so essential to the attainment of perfect vocalisation) will be undertaken by professors of the highest reputation; and as every branch of musical education other than those that have a direct bearing upon the art of singing is excluded, the attention of the student will not be diverted from the original object, viz., learning to sing.

The year is divided into three terms, of three months each. The first commencing in January, the second in April, and the third in October.

Each student will receive one lesson per week, of both separate instruction and class singing—the classes being limited to three students.

The fee for each student is three guineas for the term, payable in advance.

Examination and entrance-fee 5s.

The other branches of instruction are taught in classes, and are extra, as follows:—

Pianoforte and Harmony, two guineas; French and Italian Languages, fifteen shillings; and Elocution, fifteen shillings (per term).

Students desirous of taking private lessons from any of the professors, are requested to apply to the principal.

CANTOR LECTURES.

"ON SOME OF THE MOST IMPORTANT CHEMICAL DISCOVERIES MADE WITHIN THE LAST TWO YEARS." BY DR. F. CRACE CALVERT, F.R.S., F.C.S.

LECTURE VI.

DELIVERED ON TUESDAY, THE 16TH OF MAY, 1865.

Recent Researches on Metals and Alloys.

The importance of the subject which I intend to bring before you this evening is so extensive, that it ought to be the subject of a series of lectures instead of attempting to condense it into one, and, therefore, I shall only give a *resumé* of some of the discoveries which have been made during the last two years.

You are probably all aware that England occupies the first position among nations as a source of mineral wealth, and to enable you to appreciate the truth of this assertion, allow me to cite a few figures, published by Mr. Robert Hunt, F.R.S., the keeper of mining records at the Royal School of Mines. In 1863 the value of minerals produced was £29,151,976, from which metal of the value of £36,364,327 was extracted. There were produced—

Tin ore	15,170 tons
Copper ore	212,947 ,,
Lead ore	91,283 ,,
Silver ore	88 ,,
Zinc ore	12,941 ,,
Iron ore	3,500,000 ,,

Further, it is interesting to compare the results given by Mr. Hunt in 1858 with the above, for we find that the mineral wealth of England has nearly doubled in five years, for in 1858 the value of the metals produced amounted only to £18,105,708. I must not omit to state that, during the last few years, England has also taken the lead in the manufacture of aluminium (Jno. Bell and Co., manufacturers, Newcastle) and magnesium, by Messrs. Mellon and Co., Salford, who have adopted the method proposed by Mr. Sonstadt. As to the four new metals which have been of late discovered, viz., cœsium, rubidium, thallium, and indium, they are as yet but scientific curiosities, but as their discovery is due to spectrum analysis, I shall refer to them more especially when treating of the method by means of which the discovery of these metals has been made, an illustration of which I shall be able to give, through the kindness of Mr. Ladd, who will show you the various spectra on the screen at the conclusion of the lecture.

Since I had the pleasure of drawing your attention last year to the then novel application of magnesium to the art of photography, owing to the intense light which that metal produces (for it has been calculated to be equal to $\frac{1}{525}$th part of that of solar light, and has been seen at a distance of 28 miles at sea, and also to its intense actinic power), Mr. Bultinck has proposed the substitution of this metal for zinc in galvanic batteries, and states that he believes the substitution would prove a very advantageous one to electricians. The employment of this metal will be greatly facilitated by the large works which have been erected for its manufacture at Boston, in America.

Although Mr. Faraday observed many years ago that light was transmitted through thin leaves or sheets of the following metals:—platinum, palladium, rhodium, gold, silver, copper, tin, lead, iron, and aluminium, still we were not prepared for the interesting results that Mr. Quincke has obtained and published in the *Philosophical Magazine* for March, 1864. That gentleman endeavoured to determine directly the velocity with which light travels through metals, and he found, strange to say, that it travels faster through gold and silver than through a vacuum. Further, he adds that he was unable to detect any difference in the components of the light which had previously passed through transparent substances, such as plates of glass. The comparative rapidity of light in passing through metals and a vacuum appears to me to be in favour of the new theory of light, which I took the liberty of expounding to you in my first lecture. Although we could conceive the passage of light through a thin film of metal, still chemists were astonished when Mr. Henry St. Claire Deville, whose name I have had the pleasure of often citing in these lectures, published, conjointly with Mr. Troost, some interesting papers on the porosity of substances under the influence of high temperatures. His experiments enabled him to show that even platinum and wrought iron tubes, the latter one-eighth of an inch thick, are, when carried to a high temperature, permeable to gases. The importance of these results cannot be overrated by

chemists, when the permeability of platinum is considered, as that metal has been employed by them under the conviction that its high density and mode of manufacture destroyed all porosity. As to iron, the knowledge of that fact is most important, especially in the manufacture of coal-gas, where iron retorts are used for distilling the coal. So complete is the permeability of iron at a high temperature, that an iron tube which had been filled with hydrogen gas before the experiment was found to contain only a trace of it at the end of a few hours.

Considering the short space of time which I have at my command, I can only state that you will find in the Royal Society's Transactions (vol. 152, part 1, page 1) a most elaborate paper on "The Influence of Temperature on the Electrical Conducting Power of Metals," and also (vol. 150, part 1, page 85) one on the "Conductibility of Copper." These researches of Dr. Mathiessen deserve the the close attention of all electric telegraph engineers.

The study of metals must convince every student that, although science has progressed in a marked manner during the last 50 years, still that there is a great deal more to do than has been done. Although we have known copper, zinc, lead, tin, and iron for many centuries, still hardly a month passes without new properties of these metals being discovered, or facts connected with the improvement of their manufacture or the removal of the impurities they contain. I therefore, deem it my duty to advert to a few papers that have been published recently respecting certain impurities which particular metals contain, which impurities, in some instances, enhance the value of the metal, and in others lower their commercial value. No class of substances teaches the young chemist the difficulties and the labours he must be prepared for, if he wishes to be what is technically termed a good operator, and if he pretends to prepare a *pure* substance. I would, therefore, advise all young men studying chemistry, carefully to read the labours of J. S. Stas on "The Determination of the Equivalents of Chlorine, Sulphur, Nitrogen, Silver, Potassium, Sodium, and Lead," published in the *Moniteur Scientifique* of 1861 and 1864, where they will notice that Stas has spent months of time to obtain a few ounces of *pure* silver, lead, &c.

COPPER.—The same may be said of the researches of Mathiessen to obtain pure copper, for his studies above alluded to have enabled him to state that there is ne alloy of copper which conducts electricity better than pure copper (page 92 of the above memoir), for he found that the most minute quantities of arsenic, phosphorus, sulphur, selenium, tellurium, and oxygen diminished the conducting power of that metal. Whilst on the impurities of copper, I must not fail to mention some valuable additions which Messrs. Abel and Field have published in the *Journal* of the Chemical Society of London, on the means of determining various impurities which copper contains; thus they found sometimes traces, and sometimes several per cent. of the following impurities in many samples of commercial copper, silver, arsenic, antimony, bismuth, lead, tin, and iron (see Tables, vol. 14, page 302), and Mr. Abel, in a paper inserted in the same journal in 1864, proved that copper contained sulphur, as a general constituent, but only in minute quantities; selenium, as an occasional constituent; and that oxygen was always present and sometimes in considerable proportion; thus, in dry copper he found the quantity of oxide of copper, not as Messrs. Dick and Percy have stated, from 10·21 to 9·34 per cent., but from 3·77 to 4·56 per cent. Mr. Abel gives the following numbers as representing the average proportion of oxygen obtained with a series of samples taken in diverse stages in the manufacture of copper:—

	Oxygen per cent.
"Dry" copper	0·42
Ditto (another specimen)	0·50
"Half-poled" copper	0·20
"Tough-pitch" "	0·03
"Over-poled" "	0·03

IRON.—As far as our present day's knowledge extends, no metal is more influenced than iron, either for good or for bad, by the presence in it of a minute quantity of another element; thus a few thousandths of carbon transform it into steel, and a few per cent. of the same element converts it into cast-iron; a few thousands of sulphur, or a few per cent. of silicium, renders iron "red-short," that is to say, brittle at a red heat, whilst the same quantity (thousandths) of phosphorus makes it "cold-short," or brittle at natural temperature. These facts explain why iron smelters and manufacturers do all in their power to use ores as free as possible from these impurities, or apply all their skill to remove them from the ores or metal when present. I am therefore satisfied that all iron smelters will appreciate the value of the following facts, published by M. Caron in the *Comptes Rendus* of the Academy of Science of 1863, on the influence of manganese when used on the blast furnace to remove silicium from cast iron. The following table shows the relative quantity of manganese and silicium existing in the cast-iron thus produced:—

	Manganese.	Silicium.	
No. 1	7·93	0·05	
" 2	6·32	0·08	
" 3	4·70	0·30	
" 4	3·81	0·55	
" 5	2·25	0·76	
" 6	3·90	0·50	cold blast.
" 7	2·10	0·75	hot blast.

This table shows that as the quantity of manganese decreases in the pig iron the quantity of silicium increases; further, that the higher the temperature (all the rest of the operation being conducted in the same manner), the quantity of silicium increases and the manganese decreases.

M. Caron has further made the important remark, that it is the interest of the iron-smelter to use as much lime in the blast furnace as practicable when manganiferous ores are employed, for not only does lime facilitate the introduction of manganese into the iron, but also helps in a marked degree to remove the excess of silicium.

Eight or nine years ago I made the observation that if manganese had not the property of removing phosphorus from iron, it had the one of hiding or of counteracting the bad influence of that element on iron; in fact, I found that cast-iron, containing as much as one or two per cent. of phosphorus, would yield good mercantile iron if the pig iron contained at the same time five or six per cent. of manganese, and I have lately heard that manganiferous ores have been used with great advantage by the Cleveland iron smelters to overcome the "cold shortness" of their cast iron, which is due, as is well known, to the presence of phosphorus compounds in the Cleveland iron ore.

It is highly probable that the advantages which have been derived from the employment of "spiegeleisen" iron, in improving the quality of steel produced by Bessemer's process, is owing, not only to the fact that this peculiar iron contains a large quantity of carbon, which it yields to the molten iron contained in the large crucible used in Bessemer's process, but that the manganese it contains, contributes also to hide the influence of the phosphorous or to overcome the detrimental properties which a trace of phosphorous would impart to the steel produced by this process. I say hide, because the phosphorus is still present, since that substance cannot be removed by the above process from any pig iron in which it may be present.

M. Caron has published in the *Technologiste* for 1864, a paper in which he shows that no amount of lime on the blast will remove phosphorus from any ore which may contain it; and that tin-plate manufacturers and others who employ charcoal iron, should pay the greatest attention to the quantity of phosphorus contained in the charcoal they employ for refining ordinary iron; thus some charcoals are susceptible of yielding as much as 1 per cent. of phospho-

rus to iron, whilst others only 0·12 per cent., and lastly some only a trace.

If phosphorus, sulphur, and silicium are injurious to the quality of iron, the metal called tungsten, on the contrary, appears to improve in a marked degree its quality, especially when in the state of steel. This fact has not only been demonstrated beyond all doubt by Mr. Mushet, but also recently by some scientific researches due to M. Caron, who has proved that steel containing tungsten, presents greater tenacity, and can be used with great advantage for many purposes; in fact, he thinks that tungsten can be used instead of carbon as a converter of iron into steel. There can be no doubt that the employment of tungsten in connection with the hardening of steel, and other various applications which that metal is susceptible of, will be greatly enhanced if the fact stated in the *Chemical News* of August 25th is brought to bear, viz., that a Swedish chemist has found a simple and practical method of extracting tungsten from its ore so as to reduce its cost of production to a few shillings per pound.

Mr. R. Johnson and myself have published a paper in the Memoirs of the Royal Society, in which we showed that the conductibility of iron was greatly modified by the quantity of carbon it contained, as proved by the following table:—

	Found.	Conductibility of silver = 1,000.
Wrought iron	13·92	436
Steel	12·65	397
Cast iron	11·45	359

We also found that the hardening of steel had the greatest influence on its expansibility, for whilst a steel bar, hardened to the maximum, expanded to a degree which may be represented by 84, the same steel rendered as soft as possible, expanded only 62.

Although the oxidation of iron, or its rapid destruction under the influence of the carbonic acid and oxygen of the air, is a source of great advantage to those who manufacture this article, still in many instances it is a source of annoyance to those who possess articles made of that valuable metal, and in others it is a national loss, as in the rapid decay which our iron ships of war undergo. Allow me, therefore, to say a few words on these points.

It is easy to preserve small articles made of iron from rust, either by plunging them into a weak solution of caustic alkali (whether the iron is preserved by a peculiar action of the alkali, or because it prevents the action of the carbonic acid of the atmosphere in conjunction with oxygen and moisture, are points to be determined), or covering them with a varnish made of india-rubber, gutta percha, and a small amount of fatty matter. As to the preservation of ships' bottoms from corrosion, without entering here into the various methods that have been proposed of late to effect this important object, still I deem it my duty to call your attention to one or two methods that have been tried with apparent success; thus Mr. Leach has applied on the iron surface of ships' bottoms a coating of gutta percha or other cement, and fastening by it sheets of glass of about one-fourth of an inch in thickness. The glass is previously bent to the shape of the ship, and pierced for the reception of the screw or bolts, which are preserved from immediate contact with the metal bolts by coating them with a little of the fastening mixture.

M. Becquerel relates, in the *Comptes Rendus* of the Academy of Sciences, 1864, the results which obtained by the application of his galvano-electric process on the iron keels of some of the French men-of-war. This process is based on the same principles as those adopted by Sir Humphrey Davy, in 1824, for preventing copper sheathing from being rapidly corroded by sea water, and which consisted, as you are aware, in attaching at various distances blades of zinc between the wooden side of the vessel and the copper sheets, or, what effected the same purpose, in using brass nails for fastening the copper to the sides of the vessel.

M. Becquerel employs zinc in connection with iron, thus establishing a galvanic current which renders the iron like the copper in Sir H. Davy's experiment electro-negative, or possessing the same kind of electricity as oxygen, therefore communicating to it the property of liberating oxygen from any compound instead of absorbing or fixing it. M. Becquerel has proved that the galvanic action of the zinc on the iron exercises its influence on the whole of the iron surface of the ship, but nevertheless that its influence decreases as the square of the distance, and consequently that its action is only sufficiently powerful to preserve iron from corrosion for a limited distance, and consequently the preserving bands of zinc must be placed at short intervals from each other.

Mr. Johnson and myself published, as I hope you will remember, in the *Journal* of the Society two or three years since, two papers bearing upon this same subject, the first paper containing facts exactly identical with those published in 1864 by Becquerel; the second showing the advantage that would be derived by shipbuilders in using galvanized iron plates instead of wrought iron ones for plating our men-of-war, for you are aware that the attack of sea water on iron plates in contact with oak was very great; being 2·880 as compared with galvanized iron, which was only of 0·095, all the circumstances of action being equal in both cases.

But the most important result that Mr. Johnson and I have arrived at on this point, is the demonstration in a paper we have published on "The action of sea-water on certain metals and alloys," that the action of sea-water on lead is nearly *nil*, as seen by the following table:—

ACTION OF SEA-WATER UPON METALS.

1 Metre.	Grammes.
Steel	29·16
Iron	27·37
Copper (best selected)	12·96
Do. (rough cake)	13·85
Zinc	5·66
Galvanised iron (Johnson's process)	1·12
Block tin	1·45
Stream tin	1·45
Lead (virgin)	trace
Lead (common)	trace

This metal can, therefore, be used with great advantage to preserve the keels of iron ships from being corroded by the action of sea-water, and that the objection which might be raised as to its softness might be easily overcome by adding to lead a few hundredths of either arsenic or antimony, which would increase its hardness, and thus render it better fitted for the purpose referred to. From experiments that we have made we can further state that, in our opinion, Muntz's metal is a far superior article to copper for sheathing ships.—(See *Society of Arts' Journal*, April 21, 1865.)

As a few ladies have done me the honour to attend these lectures, it may be interesting to them to have a simple method of cleaning silver, or silver-plate, without the trouble of employing rouge or other cleaning powder, which, besides rapidly wearing off the metal, takes up much of their servants' time. It consists in plunging for half an hour the silver article into a solution made of 1 gallon of water, 1 lb. hyposulphite of soda, 8 oz. muriate of ammonia, 4 oz. liquid ammonia, and 4 oz. cyanide of potassium; but, as the latter substance is poisonous, it can be dispensed with if necessary; the plate being taken out of the solution, is washed, and rubbed with a wash leather.

Improvements have also been made of late in coating cheap metals, such as iron and brass, with more valuable ones, so as to enhance the value of the fancy articles made with them. If you remember, I referred to a process devised by Mr. Oudry for coating cast-iron with copper or bronze. The method that I wish now to bring before your notice is one devised by Mr. Weil, and is based on the same principle as the one which has been in practice

for some time in tinning iron pins, or covering brass with gold, viz., plunging the article to be coated into a boiling alkaline solution of a salt of tin, or a salt of gold; and, in the case of Mr. Weil, into one of copper, which consists of an organic salt of copper (say the double tartrate of copper and potash) with an excess of alkali, taking care that the cast or wrought iron to be coated is in contact with a brass wire during the operation.

I shall now take the liberty of dwelling for a short time on various memoirs which have been published in connection with the physical properties and chemical composition of alloys.

You will find in the "Transactions of the Royal Society," vol. 150, some extensive researches by Dr. Mathiessen on "The electrical conducting power of alloys;" also in vol. 154, on the influence which heat exercises on that important physical property of alloys. Mr. Johnson and myself have published papers on the density of alloys, as well as on the hardness, expansion, and conductibility of the same. It was admitted some years ago that alloys were simply a mechanical mixture of various metals, but the systematic researches which we have published leave no doubt, that when certain metals, such as tin and copper, bismuth and lead, zinc and copper, are employed in equivalent quantities, and that the proportion of each metal does not exceed two or three equivalents of one, to one equivalent of the other, that they are susceptible of combining and forming definite compounds. I may state, in corroboration of this statement, that if one equivalent of zinc and one equivalent of copper are melted together, or 49·32 of copper and 50·68 of zinc, and well stirred, and allowed to cool until a crust is formed on the surface, and then a hole be made in the crust and the fluid portion poured out, well defined prismatic crystals, sometimes of ½-inch long, will be found to coat the interior of the solidified mass, whilst if 45 per cent. of copper and 55 per cent. of zinc, that is to say, proportions which are no longer equivalent to each other, then, instead of obtaining a fine golden coloured crystalline alloy, a white amorphous mass will be produced, in fact, no brass founder attempts to use more than 40 per cent. of copper to produce brass, for experience has taught him that if he exceeds that quantity he obtains such a white metal that it is no more a marketable article. Another example is furnished by certain alloys for bronze. Thus, when two equivalents of tin for one equivalent of copper are employed, the conductibility of this alloy for heat is equal to that of both the metals together entering into its composition, whilst if the conductibility of alloys, composed of three equivalents of copper to one equivalent of tin, or four equivalents of copper to one equivalent of tin, is ascertained, it will be found that their conductibility is quite different and independent of that of the metals entering into their composition, in fact the conductibility of four equivalents of copper and one equivalent of tin is five times less than the one first cited.

Without occupying your time with further instances, let me call your attention to an important fact, that Dr. Matthiessen, Mr. Johnson, and myself have observed, viz., that the addition of a small quantity of a metal which may be considered as an impurity, completely modifies, in many instances, its properties, and the most important example that I am acquainted with, is the influence which the addition of one or two per cent. iron exercises on the properties of brass. If a brass be composed of 60 per cent. copper and 40 per cent. zinc, it will be susceptible of being drawn or bent when cold, but cannot be forged or worked when heated, whilst if 1·75 or 2·0 per cent. of iron be substituted for the same quantity of zinc, then a most valuable brass is obtained, for not only is this brass capable of being forged at a red heat like iron, but its tenacity is increased in an enormous proportion, for each square inch of surface is able to support a "breaking weight" of from 27 to 28 tons, a tenacity nearly equal to that of iron.

Messrs. Beyer and Peacock, of Manchester, who experimented with bolts made of this alloy, in the hope of substituting them for iron ones in the fire-boxes of locomotives, found that these bolts would support a strain equal to those of iron, and that the threads of the screw were not stripped with more facility than those of iron when exposed to the same strain.

There is no doubt than when this alloy becomes more generally known many valuable applications of it will be made in the arts and manufactures.

Whilst dwelling on valuable brass alloys let me state that two alloys have lately been introduced which will prove useful to those requiring them, namely, a white alloy, which is chiefly employed for the bearings of the driving wheels of locomotives, owing to its extreme hardness, and which is composed of:—

Zinc	77
Tin	17
Copper	6
	100

The other alloy has been lately proposed to calico printers by Mr. Lenssen as a substitute for the steel blades used by them to remove the excess of colour which adheres to the surface of their printing-rollers, and which blades bear the name of "doctors."

Mr. Lenssen's metal is composed of:—

Tin	4·93
Zinc	9·78
Copper	85·29
	100·00

This alloy is stated to have all the flexibility, tenacity, and hardness required for the "doctors" used in calico-printing, and, further, it presents the great advantage of not being acted upon by acid liquors, which action is often a great source of annoyance to calico-printers.

I shall conclude this lecture by alluding to the extraordinary modification in the fusibility of metals when several are fused together; thus, for example, the following well known alloys which liquify in boiling water:—

	Newton's alloy fusible at 212°.	D'Arcet's alloy fusible at 201°
Bismuth	5	8
Tin	3	3
Lead	2	5

Whilst the fusing point of these metals, when taken separately, is as follows:—

Bismuth	513°
Tin	451°
Lead	620°

Therefore the fusing point of each metal is several hundred times higher than when they are mixed in the above proportions.

A still more fusible alloy has lately been brought before the notice of the public by a Mr. Wood, in one of the American journals, in which he states that by melting together

Lead	8 parts.
Bismuth	5 ,,
Tin	4 ,,
Cadmuim...—	3 ,,

An alloy is obtained whose point of fusion is equal to 140 degrees, therefore susceptible of being used with great advantage for dental purposes.

I have now to refer to the four metals which have recently been discovered, viz. coesium, from *coesius*, "sky-coloured," owing to two blue lines which it produces in the spectrum; rubidium, from *rubidus*, "dark-red," owing the existence in its spectrum of two red lines of remarkable low refrangibility; thallium, discovered by Mr. William Crookes, and

which derives its name from *thallos*, "a budding twig," symbolising the beautiful green tint of budding vegetation; indium, discovered by Messrs. Reich and Richter, of Freiberg; all of which are due to the introduction into science of a mode of investigation, known as the "spectrum analysis."

The principle upon which this mode of research is based has been of late so well described and illustrated by Dr. William Allen Miller, in a paper read before the Pharmaceutical Society (see Society's *Journal*, February, 1862), and by Professor Roscoe in four lectures at the Royal Institution, London (see *Chemical News*, vols. 5 and 9), and which lectures have received such a wide publication that I think it useless here to enter into details, and more especially as Mr. Ladd will illustrate, by means of his powerful electric lamp, the spectra of some of the above metals, as well as those of potassium, strontium, barium, &c.

Notes.

Free Singing Schools in Paris.—In addition to the twenty-eight schools for adults recently mentioned in the *Journal* as having been established in the municipal schools, and which are held in the evening, there exist singing classes in all the communal schools, whether for boys or girls, which amount to 305, so that there is in all 333 classes for gratuitous instruction in singing maintained by the authorities of the city of Paris.

Storm-Charts of France.—Charts of the storms which passed over the surface of France during the summer of the present year are being prepared in the meteorological department of the Paris observatory, and will shortly be offered to the public at moderate rates, but the number of copies will be limited by the subscriptions made in advance. The publication is in the hands of the Scientific Association, which has its meetings at the observatory.

Artesian Wells.—The uncertainty which attaches to the boring for water in the chalk basin has been remarkably illustrated in France. Every visitor to Paris, who takes an interest in such matters, knows the Puits de Grenelle, the water of which is seen at the top of a high monument, and has flown, without interruption and with little variation, for several years. Ten or more years ago another artesian well was commenced by the Avenue St. Cloud, now Avenue d'Eylau, near the Bois de Boulogne, and water was obtained two or three years since, but no practical result has get been achieved, and the boring is still continued. On the other hand, a well was begun only eight months since, at Arcashon, in the Gironde, and at the end of September, when the boring had been carried to the depth of a little more than four hundred feet, the water flowed forth in an abundant and uninterrupted stream, pure and limpid. The diameter of the bore of this last work is twenty-five centimetres, or nearly ten inches English, and the supply is calculated at not less than 500 cubic metres of water per diem. The entire cost of this well is said to have been equal to £720.

Correspondence.

Suburban Railway Traffic.—Sir,—I have read with much interest the letter on suburban railway traffic from Mr. J. R. Smith, which appeared in the *Journal of the Society of Arts* on the 20th ult. The plan for expediting the traffic on these railways, therein brought forward, viz., that of attaching and detaching a carriage at each station from the train while in motion; is one that occurred to me some time ago, but the expense attending the entire reconstruction of the existing rolling stock of the railway companies, which this plan requires, is so great, that it has hitherto prevented me from bringing my plan before the public. However, as Mr. Smith has broached the subject, perhaps you will allow me to explain my views. As Mr. Smith states in his letter, there is no difficulty in detaching a carriage from a train while in motion; this is frequently done at present on some of the principal lines of railway; the real difficulty to be overcome is that of attaching a carriage to the passing train without causing a severe shock to be given to its occupants. To obviate this, Mr. Smith proposes an arrangement of a rope wound round a spring drum, but I confess I do not quite see how this would work, and if it did, it would leave the carriage attached to the train but at a considerable distance behind it. This Mr. Smith foresees, and proposes to haul the carriage up to the train by manual labour or by slacking the speed of the engine. Both of these plans I consider faulty; the first would require more power than could be exerted by one man, and the guard of the carriage would be the only person available for the purpose, unless several men were carried especially for that object, which of course would be very objectionable. The second plan, that of slacking the speed of the engine, is more feasible, but would cause loss of time, and there would be a difficulty in winding up the slack of the rope quickly enough to prevent it getting under the wheels. The plan which I propose is this: The carriage to be attached to the train would be placed in a siding parallel with the main line, but at the station this siding should be raised considerably above the level of the main line, and should fall rapidly in the direction of the junction. When the approching train was still some short distance from the station, the carriage would be started down the inclined plane, so that when the train overtook it, it would be travelling at a considerable speed, and the shock occasioned by hooking on would be so slight as not to inconvenience the passengers. Of course the rate at which the train should pass the station should be regulated to a certain maximum speed, at which practice would show this attachment could be effected with ease and safety, and therefore it would be easy to calculate the rate of inclination and length of siding which would be required to give the carriage a rate of speed which would correspond nearly with that of the passing train. The mere attaching the carriage to the train could readily be done. I propose to fix on the end of the last break-van of the train a vertical rod, revolving on a pivot with an overhanging arm, which would catch a hook on the top of the carriage to be attached to the train; on the vertical rod I would have a drum with a friction strap and powerful lever, which would be under the control of the guard; this break would keep the arm of the rod at right angles to the van until the siding began to curve towards the main line, when, by gradually decreasing the pressure on the drum, the arm would be drawn into the same direction as the train. But the real difficulty to be overcome is that of taking hold of the carriage without given it a sudden jerk, and this, I think, is overcome by my plan of the inclined plane. It is quite evident, that if the public is to derive the full benefit from our suburban railways, some means must be devised to accelerate the rate of travelling on them; and I venture to think that some similar plan to the one that has occurred to Mr. Smith and myself will have to be adopted. Hoping that some other members of the Society will favour us with their views on this subject.—I am, &c., Charles H. Beloe.

November 1, 1865.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...R. Geographical, 8½. 1. Mr. S. W. Baker, "Account of his Discovery of the second great lake of the Nile, Albert Nyanza."

Tues. ...Anthropological, 8.
Zoological, 8½.
Civil Engineers, 8. Sir Charles Tilston Bright, M.P., "The Telegraph to India, and its Extension to Australia and China."
Syro-Egyptian, 7½. Mr. W. F. Ainsworth, "On the Natural Features of Palestine."

WED. ...British Meteorological, 7. 1. Lieut. Rechecheft, I.R.N., "On Extended Series of Meteorological Observations recently adopted in Russia." 2. Mr. John Bloxam, "Temperature at Greenwich and Newport."
Society of Arts, 8. Opening Address by Mr. Wm. Hawes, F.G.S., Chairman of Council.

THURS...Linnæan, 8. Dr. McIntosh, "On British *Salpæ*." 2. Sir John Lubbock, "On *Chloeon*, part 2." 3. Mr. Hailey, "On the *Cynipidæ*." 4. Dr. Baird, "Monograph of the *Aphroditacea*, part 2."

Patents.

From Commissioners of Patents Journal, November 3rd.

Grants of Provisional Protection.

Animal charcoal, treating—2679—E. Beanes.
Ballast, &c., skips for raising—2663—C. H. Murray.
Barrow—2659—R. Stephens.
Basins, sinks, and baths, overflow for—2637—H. H. Craigie.
Baths—2749—W. Clark.
Billiard tables—2608—W. E. Gedge.
Bits, braces for—2735—J. Orvis.
Blind-cord, weaving the covering of—2681—H. E. Newton.
Boiler tubes, forming the mouths of—2697—G. R. Ghiselin.
Boots, &c.—2133—P. Lawrence.
Buttons—2753—G. A. Huddart.
Caloric or hot air engines—2675—R. A. Brooman.
Cane, splitting and preparing—2717—R. Biessy.
Centrifugal governors—2639—W. E. Newton.
Chemical toys, known as "Pharaoh's serpents"—2694—T. King.
Cocoa-nut, reeds for weaving—2691—T. Catchpole.
Corn, &c., grinding—2583—J. Priestly, W. Whitworth, and J. Sutcliffe.
Cotton, twisting or doubling—2631—J. B. Edge and E. Hird.
Date indicator—2565—L. R. Whitehead.
Electric telegraph conductors—2733—A. Parkes.
Fabrics and tissues, printing and dyeing—2701—W. Clark.
Fibrous substances, machinery used in spinning, &c.—2713—W. Sumner.
Fish hooks—2673—A. Fenton.
Fire-arms, breech-loading—2645—H. H. Williams.
Gas meters—2549—J. Webster.
Gold, &c., crushing and washing—2643—W. H. G. Jones.
Horses, blinkers for—2658—C. A. Elliott.
Hurdles—2629—R. Longdon.
Ice houses, skating places, and baths—2292—A. W. Parker.
Iron in a molten state, applying carbonic gas to—2657—J. C. Ridley.
Iron vessels, preserving and keeping clean the bottoms of—2653—W. J. C. MacMillan, J. Mason, and J. V. Scarborough.
Leather satchels, &c., gussets of—2707—F. Thompson.
Meat for food, preparing—2677—A. H. Hassall.
Meat, mincing—2437—J. Donnell.
Metal, shaping—2552—H. Hughes.
Mortising machines—2731—W. Parsons.
Motive power, obtaining—2425—G. B. McNicol.
Paraffine lamps—2616—D. Gallafent.
Pianofortes, &c.—2683—I. Gregory and E. and W. Farr.
Pianofortes, keys for—2747—D. G. and S. Staight and J. Cheverton.
Plants, dessicating the leaves and flowers of—2703—A. L. McGavin.
Polishing and brushing—2655—J. L. Hancock.
Portfolios, fastening for—2664—J. Orrin and T. Geer.
Postage stamps to letters, apparatus for affixing—2412—H. A. Davis.
Pumps—2745—H. Bateman and E. G. Garrard.
Pumps, double or single action—2622—W. E. Gedge.
Railway switches, points, and signals, working—2669—H. Skinner.
Railway trains, apparatus to facilitate signals being made by passengers in—2755—A. B. Blackburn.
Railway vehicles, axle-box for supplying oil to—2737—W. E. Gedge.
Road carriages and breaks for same—2687—J. Rock.
Roofing, tiles for—2693—J. Taylor.
Ruffles or frills—2579—C. O. Crosby.
Sabots for projectiles—2633—H. H. Williams.
Sewers, trapping and ventilating—2614—R. Abell.
Sewing machine—2532—W. R. Lake.
Sewing machines—2649—G. B. Woodruff.
Sifter—2689—C. H. Cope.
Spring bolts and sleeve links—2665—J., S. A., G. E., & F. F. Reading.
Steam boilers—2661—F. Wise, E. Field, and E. H. Aydon.
Steam boilers, preventing incrustation in—2322—W. Hewitt.
Steam consuming apparatus—2676—F. G. Sicardo.
Steam ships, &c., propelling and steering—2563—R. W. Fraser.
Steel and iron wheel tyres, forging—2695—J. Penton.
Submarine electric telegraph cables—2605—F. T. Hubert.
Table knifes and forks, securing the handles of—2671—T. McGrah.
Textile fabrics, finishing—2647—W. Robertson and J. G. Orchar.
Toothed wheels or pullies, moulding—2751—G. L. Scott.
Vegetable fibres for spinning, preparing—2725—J. H. Dickson.
Windlasses, method of working—2635—G. and A. Deslandes.
Window blinds and screens—2699—J. Ballard.
Window fittings—2603—W. Cooke.
Windows when cleaning, apparatus to be fitted to—2727—J. W. Lea.

Patents Sealed.

1270. J. Buchanan.	1315. E. Cordonnier.
1273. J. Casey.	1328. T. Craig.
1274. J. H. Johnson.	1333. H. J. Burt.
1275. R. B. Cooley.	1335. W. Clark.
1277. P. Welch.	1348. H. A. Bonneville.
1283. T. J. Mayall.	1357. R. Leddicoat.
1288. C. S. Baker.	1370. W. R. Williams.
1290. S.L.&A.Fuller & C.Martin.	

From Commissioners of Patents Journal, November 7th.

Patents Sealed.

1278. J. C. C. Halkett.	1327. T. Davis.
1284. G. Hartley.	1329. T. Parkinson and W. Snodgrass.
1294. H. W. Hart.	1345. H. Besley.
1297. J. Forbes.	1346. J. Dauglish.
1298. J. Melvin.	1361. G. Walton.
1299. P. Brash and R. Irvine.	1362. A. Chavanne.
1304. J. Goodwin.	1383. T. Marsden.
1305. J. H. Johnson.	1417. T.Calvert&D.Montgomery.
1307. W. Jameson.	1465. H. Tipper.
1309. T. J. Mayall.	1507. W. Clark.
1312. D. Ellis and M. Hillas.	2289. T. Nicholson.
1313. A. Parkes.	2337. W. J. Murphy.
1316. T. Smith and H. James.	

Patents on which the Stamp Duty of £50 has been Paid.

2985. J. Shirt.	3111. J. B. Edmonston, J. Carson, and J. Blaylock.
3052. A. Graemiger.	2987. A. C. Dewies.
2971. D. Scattergood.	3013. T.Greenwood& J.Schofield.
2978. J. McKean and T.Greenall.	3006. H. Griffin.
2969. W. Clark.	3075. E. Kirby.
2998. J. Petrie and J. Teal.	
3010. C. O. Heyl.	

Patents on which the Stamp Duty of £100 has been paid.

2429. G. Davies.	2458. J. Fowler, R. Burton, and D. Grieg.
2481. H. N. Penrice.	2505. J. L. Jullion.
2460. E. Fielding.	
2449. N. S. Dodge.	

Registered Designs.

Umbrella-holder—October 31—4750—R. Sill, jun., Birmingham.
The Stem of a Telegraph Insulator—October 31—4751—R. Jobson, Dudley.
The Tout le Monde Billiard Table—November 3—4752—Thos. Turner, Glasscobury Timber Works, Watford, Herts.

LIST OF PRESENTS.

The following Presents have been made to the Society during the past year. The thanks of the Society have been forwarded to the Donors :—

PRESENTS.	DONORS.
Specifications of Patents up to the present time, and Indexes	Commissioners of Patents.
Abridgments of ditto	,,
The Commissioners of Patents' Journal	,,
Catalogue of the Machines, Models, &c., in the Patent Museum, South Kensington	,,
Les Bains Electro-Chimiques. Dr. Caplin	Author.
Picture Cleaning and Restoring, by E. Façon Watson........................	,,
Journal of the Geological Society of Dublin, Vol. x., part 2, 1863-4 ...	Society.
Statistical Register of South Australia for 1863	W. Walters, Agent General for S. Australia.
Address to Parliament by H.S.H. Prince Alexander di Gonzaga, Duke of Mantua, 1859..................	Author.
Twenty-four hours under the Commonwealth, by John Scholefield...	,,
Report of Experiments on the growth of Wheat for 20 years in succession on the same land, by Messrs. J. B. Lawes and J. H. Gilbert	,,
Transactions of the Institution of Naval Architects, 1864	Institution.
Le Substituant Condenseur a Surface, by M. Emile Martin....................	Author.
A Letter to Viscount Palmerston on "The Employment of our Labour and Capital at Home," by G. Preston White	,,
The Farm Homesteads of England, by J. Bailey Denton..	,,
Inventors' Almanac for 1865	M. Henry.
Memoirs of the Geological Survey of India, Vol. iii., part 2, Vol iv., part 2..	Geological Survey of India.
Annual Report of the Geological Survey of India, 1863-4	,,
A general description of Sir John Soane's Museum	The Trustees.
Proceedings of the Royal Society of Edinburgh, Session 1863-4	Society.
Transactions of the Royal Society of Edinburgh, Session 1863-4	,,
Rapport Général sur les traveaux du Conseil d'Hygiène Publique, &c., par M. Adolphe Trebuchet.........	Author.
Dulau and Co.'s Foreign Catalogue, 1845	Dulau & Co.
Twenty-eighth Annual Report of the Art Union of London, 1864.........	Art Union.
Transactions of the Institution of Civil Engineers of Ireland, 25th to 28th Session, 1859-63	Institution.
A Treatise on Logic, pure and applied, by S. H. Emmens	Author.
On the Construction and Propulsion of Twin-Screw Vessels, by Capt. T. E. Symonds, R.N.	,,
Sidereal Chromatics, by Admiral W. H. Smyth	,,

PRESENTS.	DONORS.
Miscellaneous Papers on Scientific Subjects, by T. Seymour Burt, F.R.S., Vol. iii., part 2	Author.
Journals and Reports of Two Voyages to the Glenelg River, and the N. W. coast of Australia, 1863-4..	J. Martin.
Reports on the Formation of the Canterbury Plains, by Julius Haast, Ph. D.	,,
Report on the Geological Survey of the Province of Canterbury, by Julius Haast, Ph. D.	,,
Transactions of the New York State Agricultural Society, 1863	Society.
Hunt on Stammering (6th edition).	Messrs. Longman and Co.
Catalogue of the Loan Collection of Miniatures at the South Kensington Museum	Department of Science and Art.
Institution of Civil Engineers, Minutes of Proceedings, Vol. xxi.	Institution.
————————, general index of, Vols. i.—xx..................	,,
Proceedings of the Literary and Philosophical Society of Liverpool, 1863-4, Vol. xviii.	Society.
Catalogue of the Coachmakers' Industrial Exhibition, 1865............	G. A. Thrupp.
The food of man in relation to his useful work, by Dr. Playfair	Author.
Transactions of the Society of Engineers, from commencement to 1864	Society.
Mathematical Physics (2 vols.), by John Herapath	Author.
Tractatus de legibus et consuetudinibus regni Anglie, tempore Regis Henrici Secundi, &c..................	G. R. Burnell.
Exposition Universelle de 1855 Beaux Arts..............................	,,
Explication des Ouvrages de Peinture, Sculpture, &c., exposes au Palais des Champs Elysées, Mai, 1861	,,
Guide Pratique du Constructeur d'Appareils Economiques de Chauffage, par P. Flamm...................	,,
De l'Influence de l'Industrie sur les Beaux-Arts, par E. Van den Boorn	,,
Revue Archæologique de l'Exposition des Beaux-Arts de Rouen......	,,
La Reforme de l'Ecole des Beaux-Arts	,,
Réorganisation de l'Ecole des Beaux-Arts..	,,
Intervention de l'etat dans l'enseignement des Beaux-Arts...................	,,
Des Concours pour les Monuments Publics dans le passé, le present, et l'avenir, par M. Daly	,,
Du traitment Industriel des plantes filamenteuses qui peuvent être employées a la fabrication des tissus et du papier, par J. Masse...	,,
Note sur les Bétons Agglomérés Système Coignet	,,

Presents.	Donors.
Application de la Telégraphie Electrique aux usages Domestiques	G. R. Burnell.
Exposition Universelle de 1862, Catalogue Officiel, Section Francaise	,,
Considerations sur la question posée au Congrès Artistique d'Anvers...	,,
The Gas Engineers' Book of Reference	,,
Catalogue of the Library of the Institution of Civil Engineers........	,,
Catalogue of Natural and Industrial Products of Queensland at the International Exhibition, 1862	,,
Descriptive and Historical Catalogue of the Pictures in the National Gallery, by R. N. Wornum........	,,
Catalogue of the Agricultural Show in Battersea Park, 1862	,,
An account of the stopping of Daggenham Breach, &c., by Capt. J. Perry	,,
Annuario del Reale Instituto Lombardo di Scienze e Lettere, 1864...	,,
Romanum plantanum fasciculus Alter, Accedit enumeratio plantarum sponte nascentium in Ruderibus Amphiteatri Flavii auctore Antonio Sebastiani....................	,,
Navigation improved, a Treatise on the defects of Middle Latitude and Mercator Sailing, by B. Workman	,,
Reports of the Inspectors of Factories for the half-year ending 30th April, 1865....	A. Redgrave.
Transactions of the American Institute, 1862 and 1863.................	Institute.
Proceedings of the American Philosophical Society, Vol. ix., No.'s 71 and 72	Society.
Catalogue of Library of the American Philosophical Society, part 1...	,,
Transactions of the American Philosophical Society, Vol. xiii. part 1...	,,
Smithsonian Report, 1863	Smithsonian Inst.
——— Contributions to Knowledge, Vol. xiv.	,,
Smithsonian Meteorological Observations, 1854-59, Vol. ii., part 1.....	Smithsonian Inst.
The Elements of Picturesque Scenery, by Henry Twining	Author.
Statistics of the Foreign & Domestic Commerce of the United States, 1864	U. S. Treasury.
Twentieth Annual Report of the Board of Trustees of the Public Schools of the City of Washington	Trustees.
Archæologia, or Miscellaneous tracts relating to Antiquity, Vol. xxxix., part 1....	Society of Antiquaries.
Proceedings of the Society of Antiquaries, Vol. ii., No. 6........	,,
Atti della Academia di Scienze e lettere di Palermo, Vol. 2.	Count Lancia di Brolo.
Report of the British Association for the advancement of Science, Bath, 1864	Association.
Index to the Reports and Transactions of the British Association for the advancement of Science from 1831-60	,,
Principles and Practice of Medical Jurisprudence, by Dr. Taylor, F.R.S.	Author.
United States Patent Office Report, 1862	Commissioners of Patents, U. S.
Inorganic Chemistry for Science Classes, by Fearnside Hudson, F.C.S.	Author.
Life of the Marquis of Worcester, by Henry Dircks....	,,
Proceedings of the Linnæan Society.	Society.
——— Royal Society ...	,,
——— Royal Agricultural Society....	,,
——— Society of Antiquaries	,,
Transactions of the Institute of British Architects....	Institute.
American Journal of Science and Art....	Messrs. Siliman & Dana.
Dictionary of Chemistry, by Henry Watts, B.A. (in continuation)......	Author.
Proceedings of the Royal Geographical Society	Society.

CONTRIBUTIONS TO THE READING ROOM.

The Council beg to acknowledge, with thanks to the Proprietors, the regular receipt of the following Journals and Periodicals:—

WEEKLY.

Agricultural Review.
Athenæum.
British Journal of Photography.
Builder.
Building News.
Chemical News.
Cosmos.
Engineer.
Gardeners' Chronicle.
Herapath's Railway and Commercial Journal.
Les Mondes.
London Review.
Mechanics' Magazine.
Mining Journal.
North British Agriculturist.
Photographic News.
Reader.
Social Science Review.

FORTNIGHTLY.

Canadian News.
Cotton Supply Reporter.

MONTHLY.

Artizan.
Art-Journal.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale.
Bulletin du Musée de l'Industrie.
Canadian Naturalist and Geologist.
Civil Engineer and Architects' Journal.
Educational Times.
Engineers' Journal (Calcutta).
Intellectual Observer.
Journal of the Chemical Society.
Journal of the Board of Arts and Manufactures for Upper Canada.
Journal of the Franklin Institute.
Journal of the Horticultural Society.
Journal of the National Life Boat Institution.
Journal of the Pharmaceutical Society.
London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science.
Newton's London Journal of the Arts and Sciences.
Photographic Journal.
Practical Mechanics' Journal.
Presse Scientifique des Deux Mondes.
Revue du Monde Colonial.
The Horological Journal.
The Institute and Lecturers' Gazette.
Working Men's Club and Institute Union Magazine.

QUARTERLY.

Fine Arts Review.
Journal of Mental Science.
Journal of the Geological Society.
Journal of Microscopical Science.
Journal of the Royal Dublin Society.
Journal of the Royal United Service Institution.
Journal of Science.
Journal of the Statistical Society.
Popular Science Review.

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